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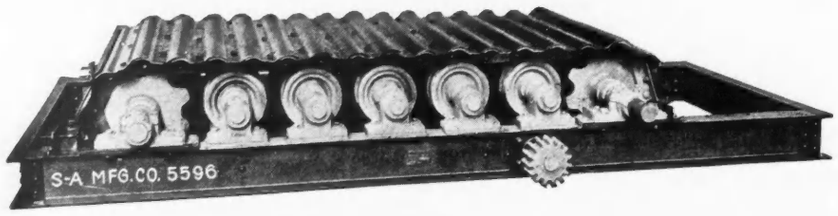
A Consolidation of Engineering and Mining Journal and Mining and Scientific Press

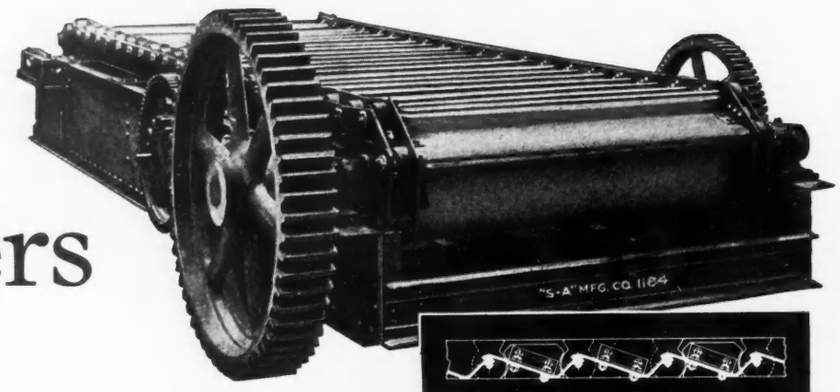
METAL AND NON-METALLIC MINING · MILLING · SMELTING · REFINING · MARKETING

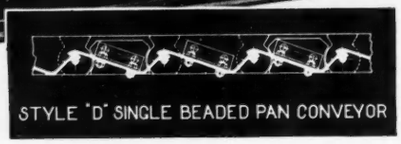
The Gyratory as a Secondary Breaker, by W. T. W. Miller—Modern Electrical Equipment in Smelting and Refining Plants, by Edgar Gealy—Ore Deposits of Chile-I, by James E. Harding—Some Tin Placer Deposits of Mexico, by Ernest H. S. Sampson

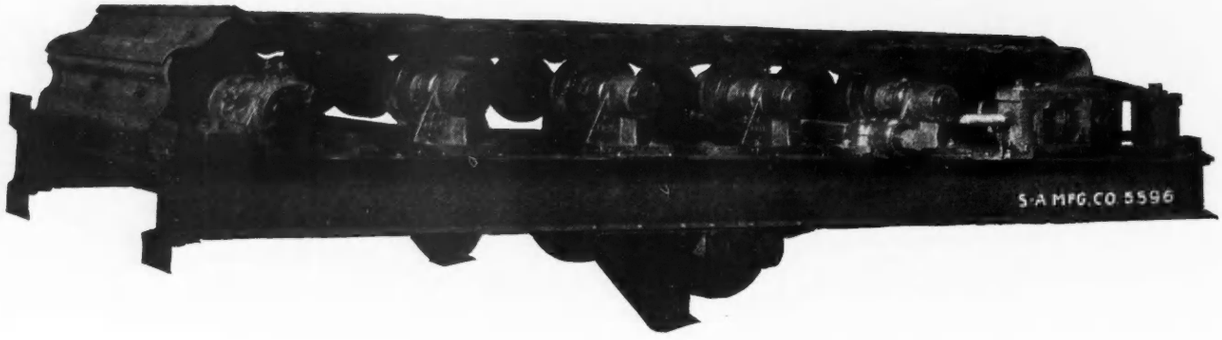
The new headframe at Anaconda's Belmont Mine, at Butte, was built outside of and inclosing the older structure, as may be seen here, without interrupting the work of hoisting



S-A Ore Feeders







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W. N. P. REED H. D. KEISER

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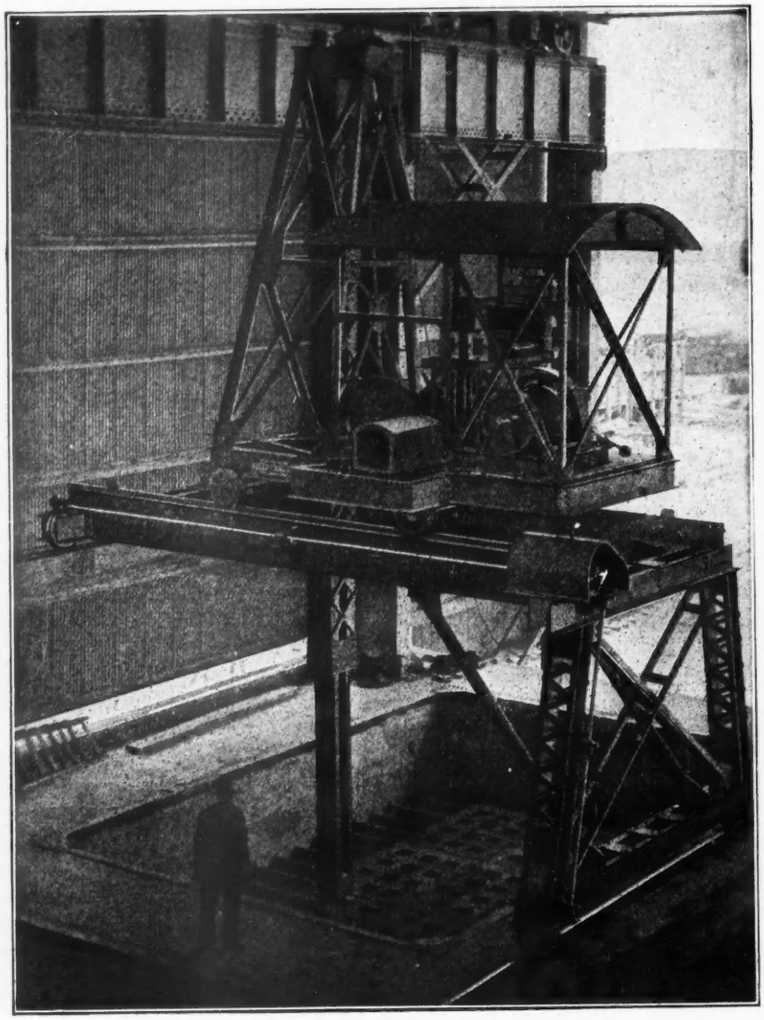

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ENGINEERING AND
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A Government Loan to Miners

SPAIN produces something like 60 per cent of Europe's supply of lead ore, and the smaller mines in that country, especially those which do not possess their own smelting works, are feeling keenly the drop in the price of lead. Having held around £33 for the last three years, a price of £23 or less, which has recently obtained, is a serious matter. Before the World War, £15 was a fair price for lead, and as Spanish exchange is not far from par, present levels should not seem excessively low to the Spanish producers—certainly not, compared with present and pre-war prices of copper and zinc. Nevertheless, with the great prosperity of the lead industry in recent years, an approach to pre-war prices is bound to hurt the high-cost producers. Even in the United States, with its protective tariff on lead, wails are beginning to be heard. A prominent official of a Western lead smelter is reported to have stated recently: "If the price of lead goes much lower it is going to be a mighty serious matter for our lead mines. Most of the large ones have curtailed and very few will be able to make both ends meet with lead selling at 6½c." It is perhaps well that the one who expressed this conviction remains anonymous.

As reported in our last issue, the Spanish Government is taking a hand in the lead situation in that country. It is not generally realized how much of a part the government plays in the industry of Spain; that country shows a great many examples of governmental price-fixing and regulation. The current plan is, briefly, for the government to set aside a loan fund of $425,000 from the national treasury, which will be used for developing and modernizing the equipment in meritorious properties; for building, acquiring, and operating co-operative mills, smelters, and warehouses; and for the more economical buying and selling of ores and metal. The loan to individual companies takes the nature of a temporary bonus to be repaid in a year, with privilege of extension in some instances. The idea of the project is to enable the small producers, by co-operative effort, to attain the efficiency of the large producers; and to tide over the "crisis of low prices."

The first of these aims is certainly a laudable one. It may be compared to the Federal Farm Loan act of the United States, to aid the farmers, which now shows outstanding obligations of over a billion dollars. The second idea—that the loan will enable producers to keep going while prices are low and will be repaid when the market improves—is perhaps the result of too much optimism as to the future of the lead market. It is perfectly possible that the price of lead will not advance beyond £25 for some years, in which case, if the Spanish Government expects to get the return of its loan out of profits, it may have to wait a long time. However, half a million dollars is not a large sum for a government to expend in these days, and is yet sufficient, perhaps, to do the small Spanish lead producers a lot of good. It is much less, for instance, than the cost of a very modest warship, which, after an economically unproductive life, would be scrapped in a few years.

When the project of Spanish governmental aid was first advanced, it is understood that price-fixing of the lead produced was embodied in the scheme. Fortunately this was abandoned, and the lead will be sold at the best price obtainable in the world market.

In the United States and other countries this Spanish project may well be studied. It would seem that the small miner is as much entitled to government aid and protection as the small farmer. The worst feature of the scheme is, perhaps, the opportunity for political patronage. It will be a very nice question indeed for the government officials to decide just how the money is to be spent. An unusual degree of governmental impartiality, honesty, and knowledge will be required.

Russia to Regain Platinum Supremacy?

WHEN THE PRICE OF A METAL DROPS 43 per cent in nine months, unusual forces must be at play. Suppose copper, for example, which was selling at better than 14c. last September, were now only 8c.; or lead, then 8¾c., were now 5c. Producers, and promoters of new copper and lead properties would be alarmed indeed. And yet this condition of affairs is exactly what the platinum-producing industry has to face. Before the price began to decline, on Sept. 22, 1926, the so-called trust price was $118 per ounce and the outside market some $5 less; now the published price is down to $72, and would-be sellers have trouble finding buyers at $64. The decline will be particularly hard on the young South African industry, and it is interesting to observe that instead of being a cause of the decline, as was feared in some quarters a year or two ago, the South African platinum producers are among the chief sufferers, though being, themselves, blameless, having produced an insignificant amount so far. The prophecy that South Africa would soon control the world's market, and the plan for an English syndicate to control prices, as for diamonds, is not, it is safe to say, receiving very much attention just at present.

Producers in Colombia, which for several years following the World War accounted for more than half of the world output, are also hard hit. Even though they can continue to operate profitably the difference between $115 and $65 is an outright loss. One company there for several years has actively increased its operations and achieved an output worth close to two million dollars a year. What of the future, then?

For many years the platinum market was closely controlled and the price largely artificial. During and following the war, the former Russian sources of supply of new metal were practically cut off, and the accumulated Russian reserves were not released freely. Recently, however, the platinum business in Russia has been reorganized throughout. A European authority, quoted elsewhere in this issue, states that old and inefficient equipment has been supplanted with modern electrically

equipped dredges, which not only cut production costs on the grade of material formerly treated, but make the handling of sand containing even less than 1 grain of platinum per ton profitable. This has added considerably to the commercial tonnage of the Russian deposits, and it has recently been estimated that as much as 7,000,000 oz. is available in the known deposits in the Urals. The Soviet Government is now selling its output direct to consumers at whatever it will bring. Unless this policy is changed it is apparent that the old monopolistic control is definitely at an end. Without doubt, some of the government's stocks of platinum metal have also been liquidated, accentuating the decline in price, but even when these come to an end it is not at all certain that prices will show much, if any, advance. Some let-up in the pressure due to liquidated stocks may result from the reported deposit, in a Berlin bank, of a large quantity as security for a Soviet loan. From now on, the price of platinum seems likely to be governed largely by the actual production cost, and as this has evidently been lowered in Russia she may regain her place as the provider of more than 90 per cent of the world's platinum.

British Activity in Steel a Good Omen

EVER SINCE THE WAR theoretical economists have been blue over the future of the British Isles. England's doles, her coal strike, her difficulties in India, Egypt, and, lastly, in China and Russia, and her ebullient domestic political, Parliamentary, and economic affairs, have provided pessimistic inspiration for commentators at home and abroad; but despite all predictions and forebodings she carries on and goes forward in the traditional British fashion. Cable dispatches record that Britain is making and consuming more steel than at any other peace-time period in the nation's history, her output promising to be about 12 per cent of the total world production, compared with 10 per cent in 1913 and only about 4 per cent last year. March of this year established the record-breaking total of 949,600 tons. Furthermore, Britain is reported to be using more steel than she can produce. Her building and engineering trades are requiring greater tonnages than at any other priod of the nation's life. Steel consumption has long been a favorite barometer of general business, so the figures of the current record contain much of cheerful significance and of hope for the immediate future. British ability steadily to carry on, in good times and bad, is a spiritual asset which rises superior to all temporary exigencies of circumstances or fortune. The British know that "if winter comes" spring can't be far behind.

On Improving Technical Programs

COMPLAINING of the fatiguing programs of some technical societies, *Iron Age* suggests that it should be made a crime to have more than three technical papers read at a single session. The criticism is none the less well pointed for all its humor. Some programs are better than others, but too often a mental feast is prepared that is far too heavy. The sparse attendance on these occasions bears mute witness that this is true. The writhing of those who stick the torture out bears further witness, and, lest this testimony seem insufficient, the editor-reporter adds his petition for relief.

Programs providing interesting speakers, who look the audience in the eye and really speak to it, are more likely to draw and hold an audience than those that fail to do so. Is it possible to arrange such interesting programs with only technical subjects on which to draw? For instance, could not a more attractive program be arranged for metallurgists than one confined to alloys? The terrifying programs of the Institute of Metals come to mind. Or is a metallurgist guilty of unprofessional conduct if he shows an interest in the human aspects of his work? Might not the program of a session be divided in two parts—talks and addresses on interesting technical subjects by interesting speakers, and technical papers of the heavier sort that are presented by title only. If it be argued that presentation by title only militates against free discussion of a paper, it may justly be replied that free discussion is the least conspicuous feature of the average technical session as now conducted. How often is the chairman's invitation in opening a meeting for discussion followed by a painful silence, as if those present were either dumb, totally ignorant, or tongue-tied, or, shall one say, more elegantly, embarrassed.

Furthermore, is it unduly pertinent to point out to those who have programs to arrange, and to those who have speeches to deliver, that a speaker is really one who speaks? Readers there are a-plenty. But if it so be that a really interesting paper must be read, cannot the reader read in a voice that will be audible more than fifteen feet beyond his collar? It is further urged that when copies of a technical paper are in the hands of every person present, it is quite unnecessary to read the paper from start to finish. In such a case a résumé or abstract is quite sufficient and will serve equally well to bring the author in person before the audience. More time for discussion would also thus be afforded.

Much can be accomplished in improving technical programs. As it is, anyone with a passion for statistics will find enough to interest him in subtracting from the number of members registered the number present at the sessions. He then may speculate, to his own amusement, as to the theaters or other places of entertainment in which they may be found.

The Widening Uses of Copper

WHETHER the price be twelve or fourteen cents, and without regard to production curves, new and expanding utilitarian and artistic uses for copper are increasingly apparent. Labor costs are so high that it pays to use the best material. In New York City one notes in the great "cathedrals" of the motion picture tons of doors and grill work in bronze or brass, and in one new office building in the metropolis door and window framing is of pure copper sheeting. Evidently architects have belatedly come to understand that copper is one of the greatest and most versatile servants that Nature has placed under man's command. Even the window and door framing and trim in small stores and buildings is to an ever increasing extent formed by sheet copper, which many artisans have found more easily worked than other metals or wood. Publicity has helped the cause, obviously, especially in home building, but the increasing preference for copper in general building construction is based largely on a wider appreciation of the many virtues—workability, sightliness, and, above all, durability—possessed by the metal in its pure and alloyed state.

Steel alloyed with some copper possesses in a large

degree the excellences of both metals. Its use should expand in construction jobs of all sorts. Makers of furniture may profit by a consideration of the desirability of copper-steel as framework for chairs, tables, and beds. Its resistance to oxidation provides advantages not possessed by iron and steel frames. The natural beauty of the metal, its cheapness, and its growing popularity assure an expanding adoption for such artistic objects as candlesticks, trays, and numerous other household accessories. No matter how often the copper pitcher goes to the well, it is never broken.

Educational Progress

MUCH of America's industrial supremacy is directly attributable to the widespread educational facilities afforded by the public-school system of the country. A small part of this system, perhaps, but not an unimportant one, are the schools in the mining districts, many of which are more or less isolated and far removed from the larger cities. These institutions offer educational advantages, usually of a high standard, at a minimum expense to the residents of such communities, as they receive practically their entire financial support from the mining company or companies operating in these districts. In view of these facts the mining industry can justly share in the gratification which the country as a whole should derive from a recent report of the National Industrial Conference Board, which states that during 1925 more than two billion dollars of the public expenditures were devoted to education in American public schools and in state universities. This amount was more than one-fourth of the total of all public disbursements of the country for the year and more than the combined expenditures for all military, police, fire protection, and prohibition enforcement. It was found, too, that over a period of years there was a greatly growing demand for education, enrollment having increased from 68.6 per cent of the 18,500,000 children of school age in 1890 to 83 per cent of the 29,700,000 children of school age in 1925. Also, a greater proportion than ever now attends high school after graduating from grammar schools, 15 per cent of all those enrolled attending high school in 1925 against only 1.6 per cent in 1890. The average school term, moreover, has been lengthened from 134.7 school days in 1890 to 169.6 days in 1925. This is progress of which the country may be proud, but in which we as a nation and of the mining industry should not rest content.

Will-o'-the-wisp at Grants Pass, Oregon

MORE OR LESS EXCITEMENT has prevailed at and near Grants Pass, Ore., over the reported discovery of tin and incidentally of a mysterious white metal. The facts as given by Frank W. Griffin are as follows: Mr. Griffin was investigating mineral properties near Grants Pass, when his attention was called to the discovery of a "white metal," presumably tin, which was alleged to have been made by a certain George Young and his associates, who owned a group of claims in the vicinity of Saxe and Mays creeks. The "metal" was obtained from a hornblende rock by means of a special furnace. Griffin was invited to witness a demonstration and was given some of the metal ostensibly obtained from the rock. The poverty of the prospectors and their apparent sincerity as well as the outcome of the experiment moved Griffin to agree to investigate the affair fully. As a preliminary the property was bonded for $100,000, payable from 10 per cent of smelter returns, no cash payments being made. This was believed by Griffin to be an adequate protection to the prospectors. Samples of the rock were taken by him as well as specimens of the metal. The first metal sample was analyzed and antimony, lead, copper, and tin were found. The percentage of tin was 79 per cent. Griffin had the rock analyzed and tested. A furnace similar to the one used at Grants Pass was made and the experiment repeated. All of the experiments were futile and the analyses and assays were negative. Other "metal" specimens were analyzed and apparently none were of consistent composition, for some were wholly zinc and others were mixtures of lead, zinc, and antimony. Occasionally some tin was found. A number of competent chemists and assayers examined the rock and metal. Their results were consistent in that nothing of a commercial nature was found. Griffin lost his interest at this time.

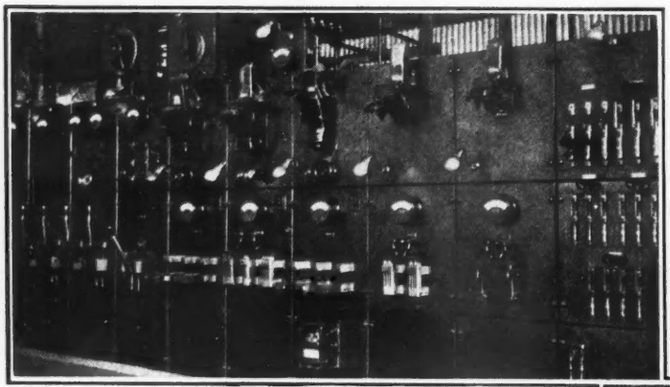
In the meantime and unknown to Griffin the fact that the property had been bonded was whispered to newspaper reporters and the story was flashed forth with all the frills known to newspaper "science." It was intimated that the American Smelting & Refining Co. and the Guggenheims were interested in the Griffin option. Our inquiry showed that neither was concerned at all. However, the newspaper yarns excited a number of people, who staked claims upon the "dikes" around about and who forthwith accepted as a fact the rumors and gossip current in the small town.

Grants Pass, it will be remembered, was the place from which emanated numerous reports and assay certificates claiming the presence of platinum and related metals. An investigation by the Bureau of Mines destroyed this "will-o'-the-wisp." Before the platinum excitement there was a tin excitement, and now another tinny will-o'-the-wisp has appeared, and in the background is still another, the "white metal." This mysterious and to date unidentified phenomenon has flashed about from as far east as Elko, Nev., through Washoe County to Modoc and then to the north of Mount Shasta, and is now hovering around the little village of Grants Pass. It is reported that government agents are on its trail.

Organic Precipitation of Copper

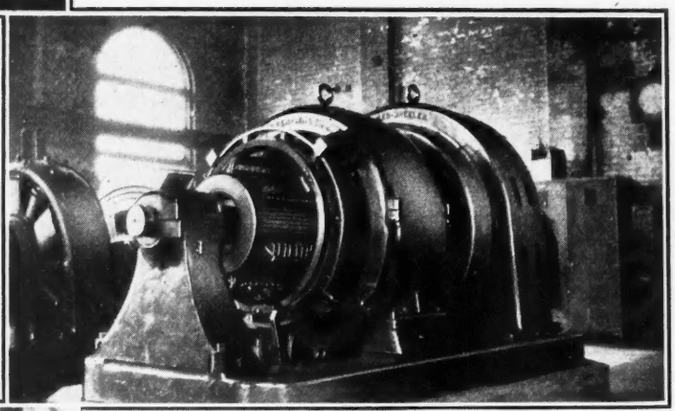
A RESEARCH STUDY by T. S. Lovering, of the U. S. Geological Survey, establishes without much doubt the rôle of organic matter as a precipitant of copper and accounts for the genesis of spongy masses of native copper found in a bog near Cooke, Mont. The surrounding region is well mineralized and several masses of pyritic copper ore outcrop half a mile above the bog. Sulphides are exposed at the surface as a result of the recent glaciation of the region. The native copper occurrence stimulated an inquiry into the possible methods of precipitation, adsorption, and biochemical action. Certain types of bacteria in a favorable media were discovered to be capable of setting up a reducing action sufficient to precipitate copper. Likewise certain organic compounds similar to those derived from decaying vegetal matter were found to precipitate copper, and led to the further conclusion that bacteria did not directly reduce copper sulphate. The work in question brings out the fact that investigative methods frequently overlap different branches of science.

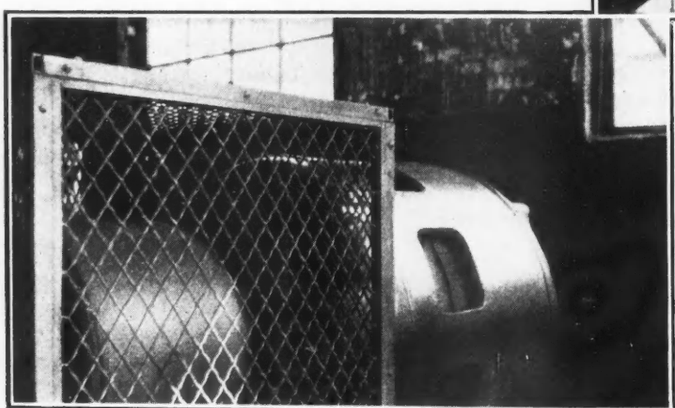
Views at the Balbach Smelting and Refining Plant at Newark, N. J.



Left—Power-distributing panels in this substation handle all the energy used around the plant.

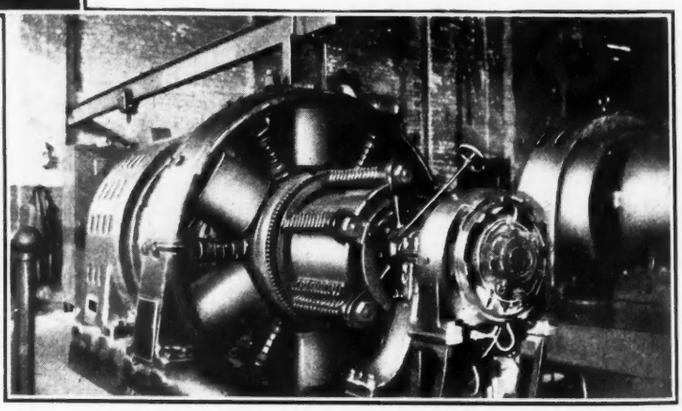
Right—Alternating current is changed to direct in this new 580-kw. synchronous motor-generator set.





Left—This alternating-current motor driving a blast fan is an example of the trend toward the use of alternating-current drives.

Right—Spare power-converting equipment. This is necessary to assure continuous service from power lines not controlled by the user of energy.



Modern Electrical Equipment in Smelting and Refining Plants

Trend Is Definitely Toward Turbo-Generator Electric Power—Alternating Current Machinery Reduces Labor and Maintenance Costs

By Edgar Gealy
Assistant Editor

NEW JERSEY smelting and refining plants are making unusual strides toward complete electrification of such operations as can be performed by machinery. Although the work is progressing rapidly, and much has been accomplished, the managements realize that they are now merely in the beginning of a big program which already shows definite signs of large reductions in operating costs.

The present period is primarily a transitional one from old to new types of drives; later, applications of machinery will be extended to many operations now involving much labor, great costs, and slow production.

Old, steam-driven machinery is being rapidly changed to accommodate electric drives, and even the steam-generating plants are experiencing revolutionary changes. Purchased power from public-utility systems seems to be uneconomical at present power costs. Only under favorable operating conditions where waste heat is not utilized is purchased power used. In most instances waste-heat boilers and the installation of highly efficient power-generating equipment make it possible to generate electrical energy at a cost appreciably under that at which power can be purchased.

Reciprocating-engine types of generators are being replaced by the geared turbine, in which energy is generated in the direct-current form, and by direct-connected high-speed turbo-alternators, in which energy is generated as alternating current. The last-mentioned motor is the most recent development in the power-generating field in smelting and refining plants.

Increasing Use of Pulverized Coal

Although oil is still holding a strong place as a furnace fuel, it is losing ground to pulverized bituminous coal at many power plants. In some instances pulverized fuel is used at the furnaces. Hand-fired boiler plants formerly utilizing bituminous coal and small-size anthracite are being changed to pulverized-fuel plants that are models of highly efficient operation. In and around them there is a conspicuous absence of manpower, yet they are as clean and orderly as a modern business office. Automatic speed regulators and weighing, charging, and driving equipment in these plants not only enable the boilers to supply the load demands as accurately as by any other system, but also do so under highly efficient operating conditions.

By generating alternating current in large turbo-generators, advantage is taken of economies made possible by the use of steam at higher pressures than are generally used and by systems of bleeding off or supplying steam for or from sections of the plant where steam is used for other purposes. The result is that heat energy is utilized with little or no waste. Even after nearly every available B.t.u. has been extracted to furnish electrical energy, the exhaust steam is further used to heat solutions in the tank rooms.

Where power-converting equipment is necessary to change alternating current to direct, for electrolytic purposes, the synchronous motor-generator set has been selected in preference to the rotary converter. This choice is in line with the general trend toward the application of synchronous-motor equipment wherever reasonably justified. Its ability to maintain good power-factor conditions has been in large measure responsible for its extensive installation.

Alternating-Current Drives Prove Efficient

Direct current for electrolytic service in the tank house is supplied in some plants at a nominal voltage ranging betwen 86 to 148 volts and with a current of from 10,200 to 10,500 amp. There is a tendency, however, toward the use of higher voltages, particularly 250 volts, forcing currents of approximately 7,000 amp. through the system. By generating alternating current instead of direct current, opportunities to extend the application of electrical energy to many operations now involving much labor and expense are presented. Simpler control, greater reliability, and cheaper installation costs made possible by the use of alternating-current drives have resulted in the adoption of automatic-control equipment which will eliminate labor, reduce operating costs, and lower maintenance and upkeep expenses.

Great flexibility and economy are possible with the new system of generating electrical energy in the alternating-current form and converting it into direct current in synchronous motor-generator sets, and, coincident with these changes, advance has also been made in applying alternating-current drives and automatic control to material-handling apparatus formerly driven by other means. The improvements in power-supply systems here described have also made possible rearrangement of circuits in the tank houses. Here the risks of short circuits are greatly reduced and much less copper is tied up. The most important feature of these changes is the manner in which they disclose opportunities to apply electrical energy to services which did not readily lend themselves to improvements under the old systems of operation. Push buttons in many instances can now be installed where workmen formerly sat and manipulated switches. Manual labor, slow speed, and imperfect manipulation of devices and transportation of materials by the former methods are rapidly becoming passé.

Ore Deposits of Chile—I

By James E. Harding
Mining Engineer, Lyme, Conn.

THIS PAPER contains the notes of a long sojourn in Chile, during which I endeavored to tabulate also to the best of my ability the geological succession and work out some of the structure. A tentative geological column is given in Fig. 1 and a strip map and cross-section of the Andes (at Chañaral) in Fig. 2. In attaching this rock column and cross-section I do so with much trepidation, for various reasons. For one thing, stratigraphing a continent is too much of a job for one man, and I freely admit that I should not have attempted this, on account of my personal lack of both

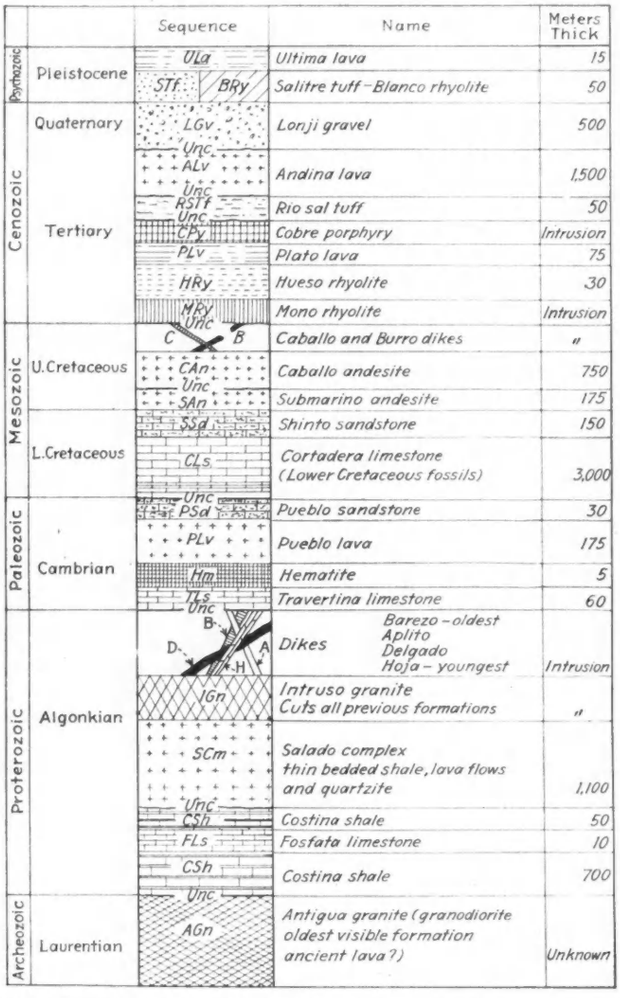


Fig. 1—Tentative geological column for Chile worked worked out by the author

erudition and ability. Nevertheless, I have made out this chart; and until someone does further work, disproving it entirely or in part, it will have to stand as the best I have to offer.

The Lower Cretaceous is the only measure in which I have been able to find fossils, and both ways from that the time divisions are made on inference alone. Quite possibly all measures older than the Lower Cretaceous will fall into the Paleozoic. There is a strong probability that some one some day will find some fossils of some sort in the Costina shales, which will definitely prove the age of that measure, and cause a revision of this entire chart. I hunted much for such fossils but could not find them. Some one else may have better luck.

Additional description of field characteristics of some of these rocks might be of assistance in classifying them in the field, especially if one is not already familiar with them. All the lavas of the Salado complex have a peculiar reddish brown colored surface, which is noticeable. These lavas have a fairly dark gray groundmass with granular texture, so that once known will always be recognized. Conglomerates are common. The Caballo andesite lavas are darker brown, with no trace of red on exposed surfaces. One measure of this only is red, and that bright-red conglomerate. Other measures are greenish gray, almost the green of malachite in places. Conglomerates are common. On fresh fracture the color is darker gray than the Salado. In the Andina lava there is one red bed and all the rest are nearly black. The groundmass is the darkest gray of all, with very few phenocrysts. Conglomerates are rare, except in the mudflows.

The Mono rhyolite, Hueso rhyolite, and Cobre porphyry resemble one another very closely, but can easily be told apart in the field for the most part. Mono rhyolite is the darkest colored of the three and the most coarsely crystalline, with abundance of femic minerals and biotite. It occurs in massive mountain intrusions, generally with a long axis oriented north and south. Hueso rhyolite generally has flow structure, no biotite, some muscovite, with blebs of silica scattered here and there, sometimes thickly. This Hueso rhyolite is really a flow phase of the Mono rhyolite, where the intrusion welled up and bubbled over in wide fissures and sent these flows out over the surface in the form of a laccolith with the air for a covering, and weathers nearly white.

The Cobre porphyry occurs in small stocks and sill-like intrusions. Its color is lighter, when unstained by iron, than the Mono rhyolite. Its texture varies from aphanitic on contacts to phanerocrystalline within the mass. Biotite is sparingly present. Generally its surface is heavily stained with oxides of copper which give it a striking green color on weathering.

Rio Sal tuff can always be distinguished because it shows a striking lavender color at a distance when it is weathered.

The most widespread occurrence of metal along the western slope of South America is copper, which occurs in all formations from the very oldest; and in the aggregate, since the mining industry was started, a very large amount has been produced. Practically all the early production came from veins along the coast range, and these veins are generally connected in some way with the great Salado fault, which with its various ramifications and offshoots may be traced for a distance of nearly 2,000 km. In general it may be stated that this fault divides the coast range into two sections, about two-thirds of the range lying to the westward of the fault and about one-third to the east. The fault dips to the west at a fairly low angle, from 45 to 30 deg.; the west-

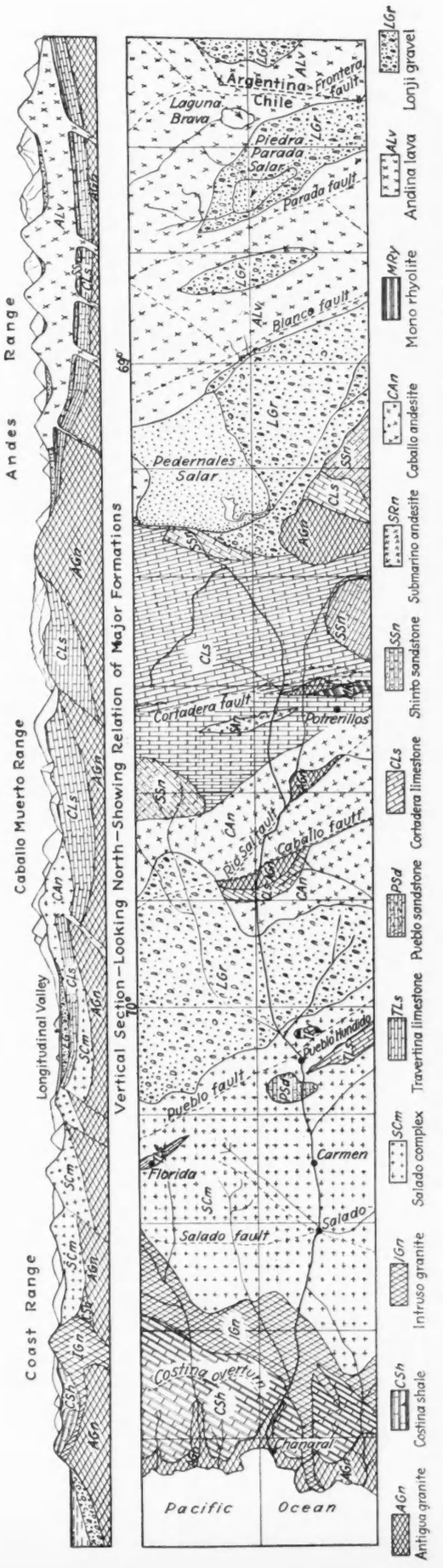


Fig. 2—Generalized geological cross-section of western slope of Andes mountain range at Chañaral, Chile

ern section is overthrust on the eastern, and in it many parallel fractures with minor faulting were produced. In addition to the parallel fissures, there are also many connecting fissures, meeting the parallel fissures at angles of about 30 and 150 deg.

Before the deposition of copper minerals, considerable gouge had been produced by the faulting; and in almost all cases the mineral veins occur as a replacement of this gouge. The primary minerals generally were pyrite, chalcopyrite, specular hematite, calcite, and quartz, with minor quantities of rarer minerals. Molybdenite as a primary mineral is of common occurrence. The proportions of the various constitutents vary greatly—to such an extent, in fact, that the content may vary from almost straight silica to straight hematite gangue, with the copper generally low in grade.

Oxidation of the surface and down to permanent water level has been complete, but on account of the lack of water for dissolution and concentration, the oxidized copper has not been carried away. There has been, however, a downward concentration of oxidized minerals, which has produced an enrichment zone of oxides close to surface, which in general is the richest part of the mine. Below the zone of oxide concentration there is a nearly barren oxidized zone and then a zone of secondary enrichment. This secondary enrichment zone is generally very thin; and in case the primary ores were lean the mines are short lived and play out at shallow depth. In fact, in all Chile only one mine has been worked to real depth, and that is the Dulcinea, near Copiapo, where high-grade primary chalcopyrite is being mined at a depth of 1,037 meters. Besides this one, there are probably not a half dozen mines in the entire country which have had payable ore at a depth of 400 meters. Thousands of mines and veins have been worked to a shallow depth only, taking out the shallow oxide zone and never even attempting to drive to a possible deeper zone of sulphides; in others the operators have sunk workings to the sulphides, mined out a thin secondary enrichment zone, and quit. Therefore, for the most part, Chile's copper has been produced from many small and shallow mines, practically all of which are now abandoned.

For the past several years about 90 per cent of the country's copper production has been coming from two mines, Chuquicamata, owned and operated by the Chile Copper Co., and Teniente, owned and operated by the Braden Copper Co., both American enterprises. Both these are large low-grade concentration operations and are able to produce copper cheaply enough to compete in the world's markets.

A third mine of the same type, the Potrerillos, owned by the Andes Copper Mining Co., is now being developed and is coming into the production stage.

CHUQUICAMATA

The Chuquicamata orebody is one of the largest in the world, both in point of tonnage and metallic content. To date, about 750,000,000 tons of ore, running about 2.70 per cent copper, has been developed. The geology of this deposit, although relatively simple, possesses many interesting features.

One of the large continental faults has brought the Antigua granite (Fig. 1) to light on both sides of the same fault; and, using the shear zone of the fault as a road of ingress, a large mass of porphyry (Cobre porphyry) was intruded, welling up without disturbing

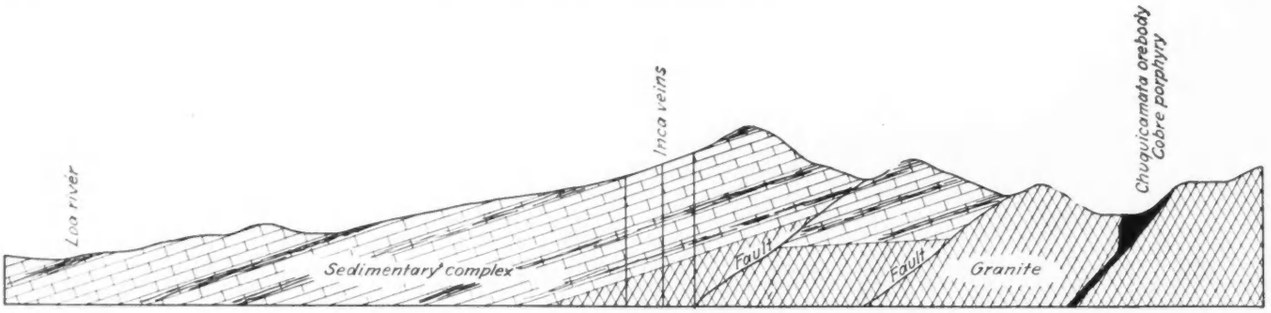


Fig. 3—Sketch section of geology through Chuqui-Inca, Chile, looking north

the footwall to any appreciable extent, and making a place for itself by forcing up and back the already brecciated Antigua granite of the hanging wall. The intrusion presents to view a surface area of nearly three square kilometers, nearly all of which is mineralized. Ore has been developed vertically for almost 600 meters in one spot only, at which location bottom is not reached; and it may truly be said that there is no definite knowledge of how deep the ore goes. Erosion has removed considerable from the outcrop and also has caused the sedimentary complex to retreat horizontally about 4 km. See Fig. 3. Since the intrusion of the copper-bearing magma a little faulting has taken place, which has moved some sections horizontally from west to east, but these are of no importance and are not even taken into account in mining.

The orebody is being mined by steam shovels and treated by leaching and electrolytic deposition, at the rate of about 22,000 tons per day. So far only the oxidized zone is being mined. Mineralogically this oxide zone is unique, and comes in reasonably and naturally in such desert conditions. For the most part the oxides are in some form of sulphate, chloride, or carbonate combination, all easily soluble in a dilute solution of sulphuric acid. The minerals are brochantite, pisanite, atacamite, chalcanthite, malachite and azurite for the most part, but there are many other and rarer combinations.

The region was formerly also covered by the tuff blanket mentioned in an earlier article in connection with the nitrate deposits[1]; and sulphates still are and always have been present in abundance in sand, gravel, and rock, together with chlorides, to furnish that part of the radical in the copper combinations. New supplies of both sulphates and chlorides are continually arriving in the wind-laden dust which comes up from the pampa to the west and from the Loa River valley near by, which valley is still largely filled with the ancient tuff mud, from volcanoes farther back in the Cordillera. The copper undoubtedly existed primarily, in the magma itself, as chalcopyrite or some other form of sulphide, and has been brought to its present state by oxidation. In just what form the sulphides exist below, is, I believe, not generally known.

[1]James E. Harding: "Genesis of Chilean Nitrates." *Engineering and Mining Journal-Press,* Vol. 121, No. 22, May 29, 1926; pp. 885-888.

POTRERILLOS

The Potrerillos orebody lies about 450 km. to the south of Chuquicamata, in the same mountain province. It consists of an irregular frying-pan-shaped stock of Cobre porphyry intruded along the Cortadera fault (another of the continental fractures) and inclosed in Lower Cretaceous limestones. The surficial area of the outcrop of the stock is about half a square kilometer, and in it have been developed 150,000,000 tons of ore running about 1.5 per cent copper, with almost no gold or silver. About one-third of the ore is oxidized.

Originally the stock intruded in a wide fracture zone, along which the fault had moved a great distance, previous to the arrival of the ore magma. Here also the intrusion caused no disturbance on the footwall side of the fault and made room for itself by thrusting aside the already brecciated and fractured sedimentaries on the hanging-wall side of the fault. Another and smaller mineralized stock is located a few hundred meters to the north of the main mass, but has as yet not been explored.

The inclosing rocks are much more complex than at Chuquicamata. Those rocks that are exposed are

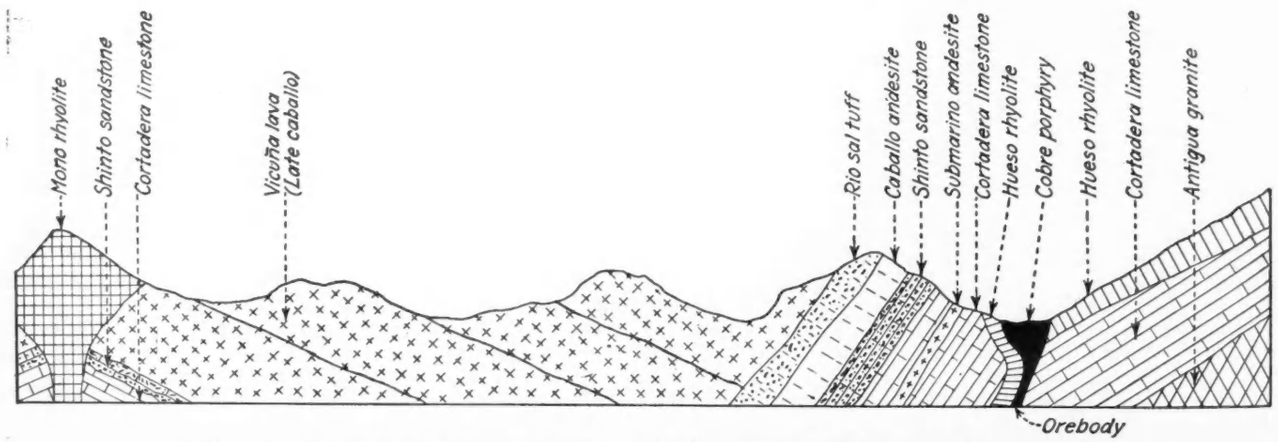


Fig. 4—Section through Potrerillos, Chile, length 20 km., looking north

Cortadera limestone, Shinto sandstone, Rio Sal tuff, and Submarino andesite. The region immediate to the orebody also has two other porphyritic members, the Mono rhyolite and the Hueso rhyolite, the former an intrusion and the latter an extrusion, all belonging to the Rio Sal series (Fig. 4).

Originally, considerable difficulty was encountered in working out the field relations of the three porphyries, and at length a method was derived by which each one could be determined. In appearance they are much alike, especially when coarsely crystalline. There is, however, a difference in the color of the groundmass and a different arrangement of femic minerals by which they may be distinguished. Of the three the Mono has the darker groundmass and most femic minerals, the Cobre the medium groundmass and some femic minerals, while the Hueso has a very light-colored groundmass and very few femic minerals. Muscovite is found in the Hueso porphyry and never in the other two; biotite is fairly abundant in the Mono and sparingly present in the Cobre. The Hueso was a surface flow, and is intercalated between the strata of the sedimentaries and placed there by overthrusting, and not by intrusion or overdeposition.

The minerals at Potrerillos are very different than at Chuquicamata. Sulphates and chlorides are practically absent. About 90 per cent of the oxidized copper is in the form of malachite, the rest being covered by azurite, chrysocolla, tenorite, and cuprite. There are some rare minerals present. One vein is of beautiful chalcophyllite, and another of a red silicate of copper and another olive-green silicate of copper and arsenic.

Here there is an important zone of secondary enrichment, with the copper largely present as chalcocite. Chalcopyrite is the form, however, in which a large proportion of the copper is found. Enargite is common; and veins of molybdenite are found in several places throughout the orebody. Also out in the sedimentaries there are one or two small lead veins, carrying galena and a small amount of sphalerite.

In the sedimentaries are developed some interesting zoning effects, especially on the western or hanging-wall side. From the point where the Cobre porphyry contacts with the sedimentaries, the latter are pyritized in a zone about 50 meters wide, with an average of about 8 per cent pyrite. Then comes a zone about 5 meters wide, almost always at a nearly equal distance from the periphery of the porphyry, much enriched in pyrite, carrying about three times above the average amount. Outside of the pyritized zone there is a zone about 10 meters wide which is heavily garnetized. The entire pyritized zone carries about 0.45 per cent copper. The pyritized zone does not now lie in its former relation (horizontally with the porphyry orebody), as it has been upthrust, by later faulting, to 138 meters higher than it was at the time of the intrusion. Since the intrusion the contact has served as a line of weakness, on which there has been much movement, and wide gouge masses have been produced, so that it is impossible to tell whether the intrusion produced great disturbance or was gentle in its nature. In such gouges considerable native copper is found.

Thus at Potrerillos and at Chuquicamata we have two orebodies which in many ways are almost duplicates, except in size and inclosing rocks. They both are intrusions, along a continental fault, of magmas which in cooling produced the Cobre porphyry; and samples of the ore rock from each location show almost identical characteristics. The minerals of copper are different, because at Chuquicamata oxidation has been carried on in the presence of excess chloride and sulphate material, which was present more sparingly at Potrerillos, where water was more abundant than at Chuquicamata. In both cases, the Cobre porphyry very closely resembles in general appearance the monzonites, so common in Nevada and Utah, which carry copper. However, the excess of plagioclase feldspars in the Cobre porphyry will not permit that it be classified as monzonite.

El Teniente

The Teniente mine is located south of Santiago and also about 1,500 km. south of the Potrerillos mines. The orebody is also one of the most remarkable in the world. In a fairly regular elliptical shape, about what Lindgren terms an ancient crater, has been developed some 300,000,000 tons of ore carrying about 2.40 per cent copper. The width of the ore varies, at points about the ellipse, from very narrow up to widths of over 200 meters. Vertically the ore has been developed for over 600 meters, and the bottom is supposed to lie yet deeper. The rocks inclosing the orebody are andesitic lavas, belonging to the Caballo series in age. At the mine their depth is not known, but they are dissected to their base in the canyon of the Catederal River, about 40 km. away. At that point there is 1,200 meters of the andesite, resting on Antigua granite. The depth therefore at Teniente may be greater or it may be less; but the difference should not be great.

In the region in which this property is situated, the climate is very humid. Tremendous falls of snow come every winter, and in the summer rains are not infrequent. Erosion has been so rapid that no oxide ore zone has been permitted to form, and sulphides outcrop almost at surface. The locus of the ore is almost altogether in the cracks of much-brecciated Caballo andesite, of which many flows are shown in the mine workings. The cracks have opened up to a width of sometimes as much as a centimeter, and are filled with finely triturated tuff carrying minerals of copper, together with much tourmaline in small radiating crystals.

Chalcocite is probably the most common copper mineral; there is also a small amount of bornite present, with a large amount of chalcopyrite. Bodies of nearly pure tennantite are occasionally encountered; these sometimes are of such size that they would make small mines in themselves. An interesting feature of this tennantite is that it oxidizes readily to the mineral chalcophyllite, which is frequently found as a coating on the sulpharsenide particles and masses. Sometimes caves are encountered in the orebody and in these are found huge crystals of gypsum—up to over a meter in length, with a base about 35 cm. by 15 cm.

Mr. Lindgren's opinion that this orebody is formed about the periphery of an extinct crater is interesting; and certainly, coming from a geologist of such standing, it cannot be lightly cast aside. However, I am obliged to state that I cannot see the slightest suggestion of a crater, extinct or otherwise, at the location of this orebody; and there are certainly several craters, carrying no ore, a short distance farther up the river valley, from which I do believe that the lava flows at the Teniente came.

All the fissures in which there is ore are tension cracks, giving a strong suggestion that the lavas here

have been domed up from below. I strongly suspect the existence of a laccolith of Cobre porphyry beneath the Teniente orebody, especially since there is a dike cutting through the Fortuna outcrop (the eastern section of the orebody); and this dike is of material in all ways similar to the Cobre porphyry which is found at Chuquicamata and at Potrerillos. If it be true that such a laccolith underlies the orebody, then it would be simple to account for the copper, as emanating from such a laccolith at a period when it was in semi-liquid form.

It is quite true that the outcrop of the orebody is heavily stained with limonite and also much kaolinized, in more or less circular form, suggesting at a distance a crater; but this circular area upon close examination reveals itself to be merely an oxidized, bleached, and stained section of the surrounding reddish andesite, with no suggestion of a crater. As a capping of one section of the orebody, there is a highly siliceous light-colored tuff stained with copper. This tuff may just as well have come from any one of a half dozen extinct craters in the vicinity; it correlates with the Salitre tuff and is much later in age than any of the other copper-bearing formations farther to the north.

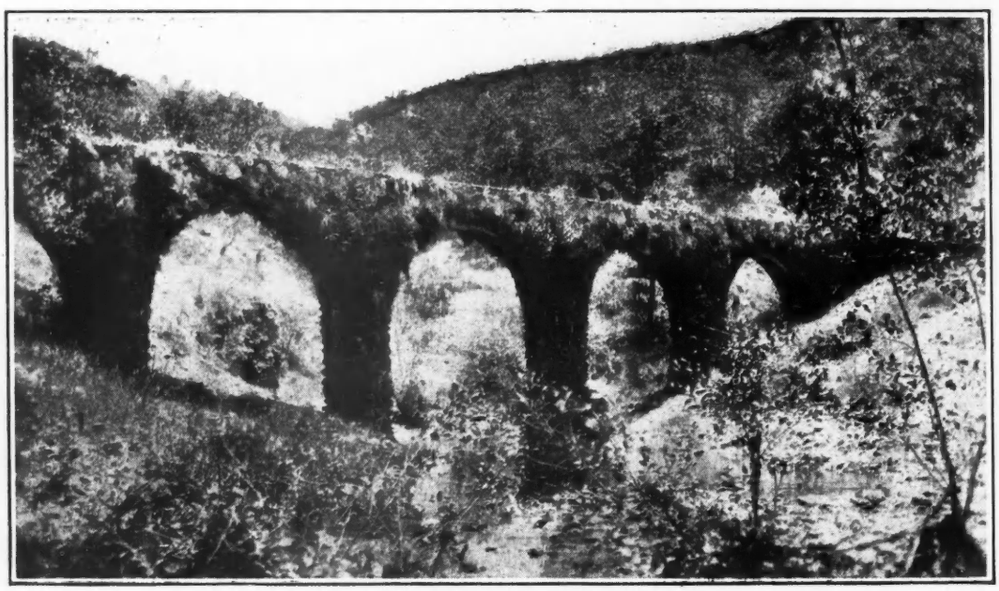
Thus we have three very large and important orebodies strung along for about 2,000 km., in the same general mountain province, of which certainly two and possibly the third owe their genesis to similar conditions. In between there are several other and similar orebodies, as yet unexplored. Some of these apparently might develop important tonnages of ore; but owing to their geographical location, high altitude, or other feature conducive to expensive operating conditions, do not seem to be very attractive at present.

Among the vein deposits there are representatives of practically every known type, from straight replacement deposits in limestone to the usual fissure type with quartz and pyrite gangue, and still others consisting of an almost pure specular hematite gangue, carrying copper minerals.

Undoubtedly, in the case of fissure veins, replacement has played an important part. The usual conditions of such a vein are a previously existing fault fissure, with gouge; this has been later replaced with quartz and sulphide material, with specular hematite almost never absent. The shape of such vein orebodies will be roughly tabular, for a distance replacing the gouge from wall to wall; and then will taper out to a mere stringer along the footwall, while the gouge continues on indefinitely with a uniform width. Along one such gouge, which is continuous for a distance of nearly 15 km., three small mines have been worked, the total length of the three ore lenses being less than 1 km. The fissure here referred to crosses the Chañaral gulch about a kilometer below Punta Negra, near Salado.

It is not unusual to find a marked vertical zoning in the gangue material of the vein filling. An ideal type of such zoning would be at the top about 60 meters of almost pure calcite gangue, with low value in copper; then, below this, about 150 meters of ferruginous gangue with high values in copper; followed to an indefinite depth by a zone of siliceous gangue carrying lower values in copper. The copper minerals conform to the usual series, with chalcopyrite largely present in the primary ores. Malachite is the most common oxide form, with frequent occurrence of azurite and cuprite. Melaconite and tenorite are common and especially atacamite and brochantite. Bornite is very rare; it, however, does occur as almost the only primary mineral at Los Sapos, near Combabale; but I have never seen it generally as a secondary mineral. A striking and common ore is chalcocite in a gangue of hematite, which is quickly noted by the blacker sheen of the chalcocite and often runs over 50 per cent copper. Enargite is common, especially in the porphyry deposits. In addition to these, many rare minerals have been discovered and classified. Although there are many details in common, almost no two districts have either the same vein or mineral habit.

(To be continued)



Ancient Spanish Aqueduct at El Molino, Guanajuato

The Gyratory as a Secondary Breaker

By W. T. W. Miller*
Engineer in Charge Crushing Machinery Department Hadfield's, Ltd., Sheffield, England

WHEN THE GYRATORY became established as a successful machine for the normal crushing processes, efforts were made to modify the design to make the breaker more suitable for secondary or finer crushing. In the smaller sizes of standard gyratory breakers the finest settings gave products varying from 1 to 1½ in. and secondary crushers were required to reduce the material to three-quarters and even half-inch product if possible. The demand for these finer products has increased enormously in recent years, and the result has been that a separate and distinct series of machines has been developed for this particular service. It will therefore be instructive to trace the evolution of the gyratory as a fine crusher, emphasizing the special features in design which have been embodied to meet the arduous conditions of this special duty.

With one or two exceptions, gyratory crushers were built with a gradually increasing crushing stroke; in other words, the head was so placed between the fulcrum and the eccentric end of the lever shaft that the movement at the top of the cone was less than half that at the lower or outlet end. With a movement of this character the maximum size of product is determined by the greatest width of aperture between head and concaves at the outlet, and this width includes the total crushing stroke plus the necessary working clearance, the latter being equal to the minimum distance within which the head can approach the concaves without causing packing or fouling of the liners themselves.

A minimum crushing stroke of about three-sixteenths of an inch is necessary to break the larger lumps at the top of the cone, giving a movement at the point of egress of approximately ⅜ in., to which must be added a clearance of ⅛ in. to ¼ in., making the minimum setting about half an inch or a little more. This explains why it is rarely possible, in a variable aperture machine, to obtain a product much finer than ¾ in.

The liners or concaves forming the outer crushing faces are not usually machined and are subject to variations in thickness and diameter, and the head itself is not always perfectly circular. It follows that it is extremely difficult to maintain an equable fine setting without running the risk of packing or even touching metal to metal. Either of these happenings is sufficient to cause hot bearings and excessive strains throughout the machine. These difficulties were fully understood by the early gyratory builders, and some ten years after 1880, when the Gates Ironworks began to construct gyratory crushers, the design shown in Fig. 1 was patented by this company. The mechanism was similar to that used in the company's standard breakers except that the lower ring of liners inside the concave casing or crushing basin was backed by springs so that the head could be brought close with impunity and without risk of damage to the working parts. This attempt to make the machine into a pulverizer does not appear to have met with success, and it is doubtful whether many breakers of this type were put into service. It is mentioned to show that as far back as 1890 efforts were made to change the gyratory into a fine crusher.

About the same date Lowry introduced the machine shown in Fig. 2; and two features in this breaker are of special interest. In the first place, the crushing stroke was greatest at the top of the cone and smallest at the outlet, so that, in this respect, it was one of the rare exceptions to the general rule. This reduction in the crushing stroke at the bottom of the head made it possible to obtain a closer setting and a more regular sizing of the finished product, for the reasons indicated in the opening paragraphs.

It is sometimes claimed that it is an advantage to have

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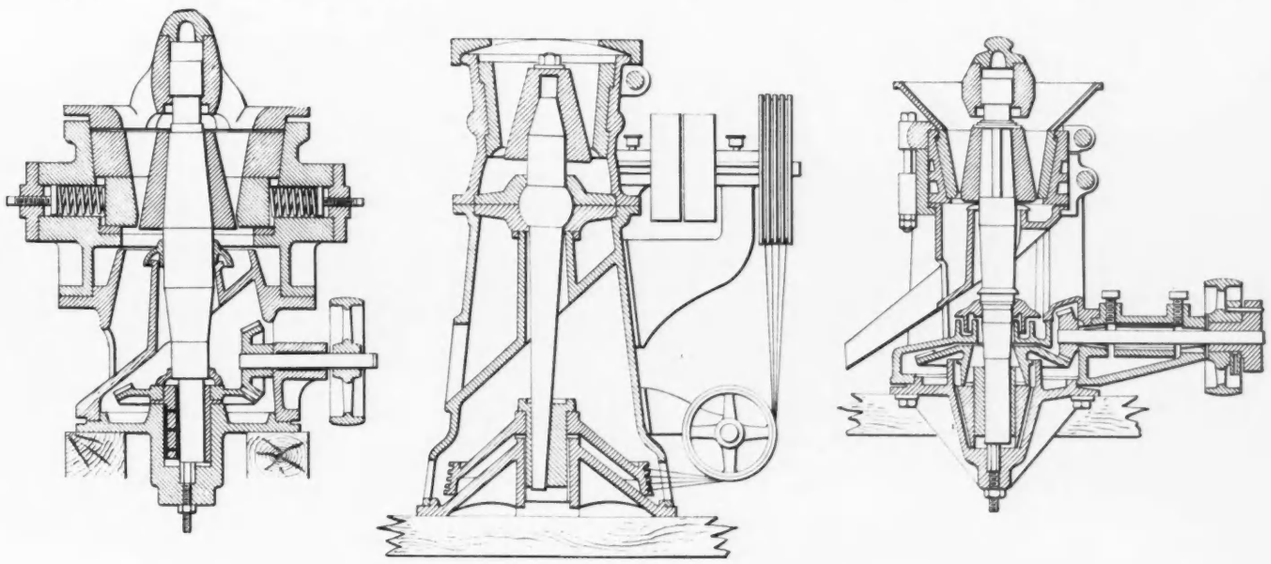


Three early types of gyratory crushers

Fig. 1, left—This machine was designed about 1890 in an unsuccessful attempt to convert the gyratory into a fine crusher. Fig. 2, center—A breaker introduced by Lowry at about the same time. Fig. 3, right—The Gates Ironworks Style "F" fine crusher, in which greater protection was afforded for gears and eccentric bearing and better facilities for changing working parts.

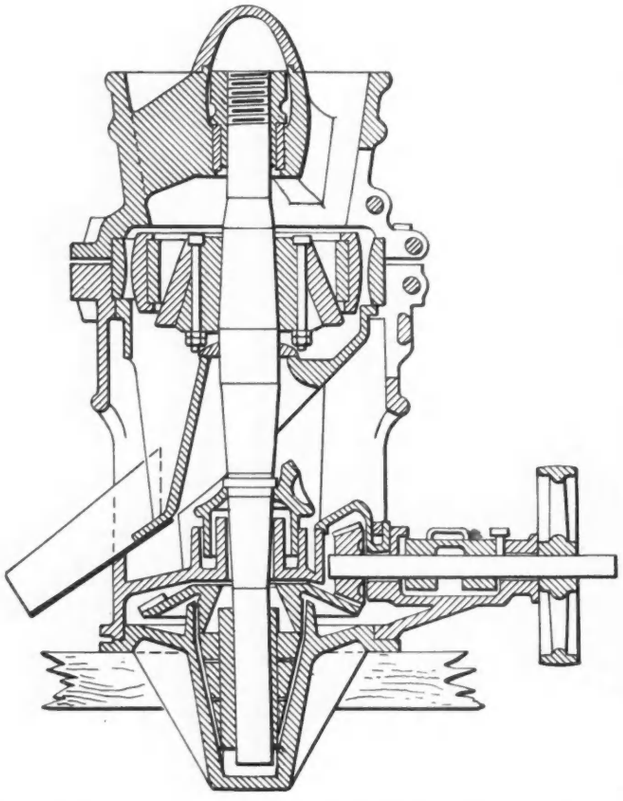


Fig. 4—The Gates Style "H" fine crusher was considerably larger than the Style "F" crusher and was one of the first to be fitted with a suspended shaft by the company

the greatest movement for crushing the largest lumps and the greatest leverage for reducing the smallest pieces. This may be correct if packing takes place during the final reduction, but it is always better to avoid packing and choking, as such a condition leads to overstrain. Free crushing is the ideal system of operation for any crushing machine.

In the perfect breaker the rate of crushing should increase as the area of the aperture diminishes, but the large movement near the feed point causes the action to be more rapid in the upper part of the chamber, which leads to choking as the stroke reduces.

The second feature of interest in the Lowry breaker was the elimination of the bevel gears and the introduction of the right-angle rope drive for the eccentric, as shown in the illustration.

The spherical bearing for the fulcrum of the main shaft was undoubtedly a source of weakness in this machine. This bearing was badly placed in the path of the crushed product, making it difficult to exclude dust and fine grit, and the construction of the bearing was such that it was almost impossible to make any adjustments to compensate for wear. With the constant reversals of stress on the shaft any slackness in this bearing must have been a hindrance to successful operation.

As previously stated, the Gates Ironworks and their successors, the Allis-Chalmers Co., made very persistent efforts to perfect and improve their fine-grinding gyratories, particularly in the smaller units. Fig. 3 illustrates their Style "F" fine crusher. This small machine was similar in principle to the larger breakers built by this company, but one or two changes were made in the details, to provide greater protection for the gears and eccentric bearing, and better facilities for changing the wearing parts. In this breaker the crushing basin was supported from the base by four hollow columns, and the collecting chute was a loose casting made in such a manner that the crushed material could be discharged in the space between any pair of columns except on the side occupied by the countershaft bearing. The concaves were held in a circular container which could be quickly removed by releasing the spider so that a spare ring, kept lined and ready for immediate use, could be inserted within a short time. The gears and eccentric were completely housed, and a collar, working in a groove filled with oil, sealed the hole through which the main shaft entered the gear chamber and effectively excluded dust or water mixed with grit. This little crusher was designed to crush material from a feed size about 1½ in. cube to a product of ⅜ in. and under.

The next figure, No. 4, shows the Gates Style "H" fine crusher, which was considerably larger than the Style "F" breaker, having a feed opening seven inches wide. The concaves were short and set vertically in a reversible ring holder, so that, when the lower circular edge had become worn, the containing ring could be reversed bodily, presenting a new wearing face at the lower edge. Instead of dividing the taper equally between the head and concaves, as was customary, this machine was designed with a wide-angle head made up of a center casting covered by a renewable shell held in position by clamping bolts. The head projected for some distance below the concaves, giving ample vertical adjustment to compensate for wear. The revised shape of the concave ring enlarged the diameter of the outlet circle and increased the area for the final crushing process, which was

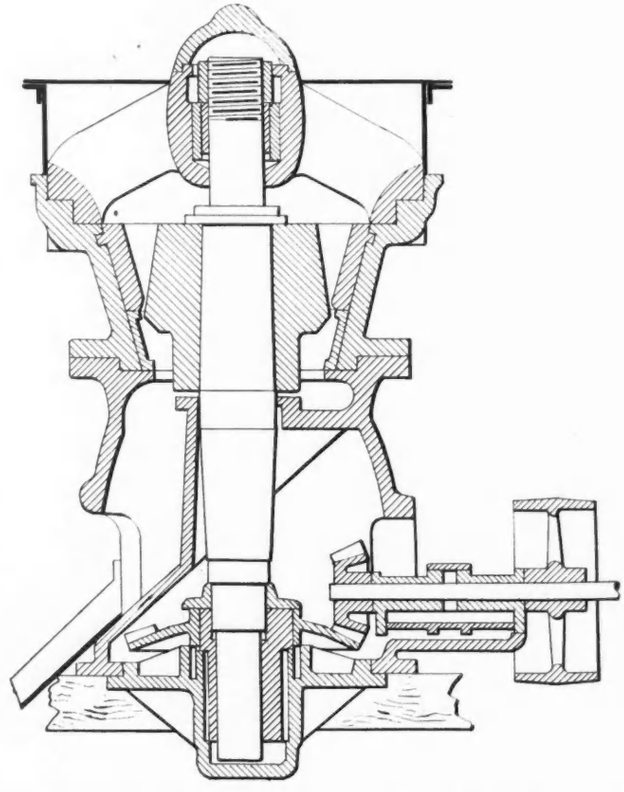
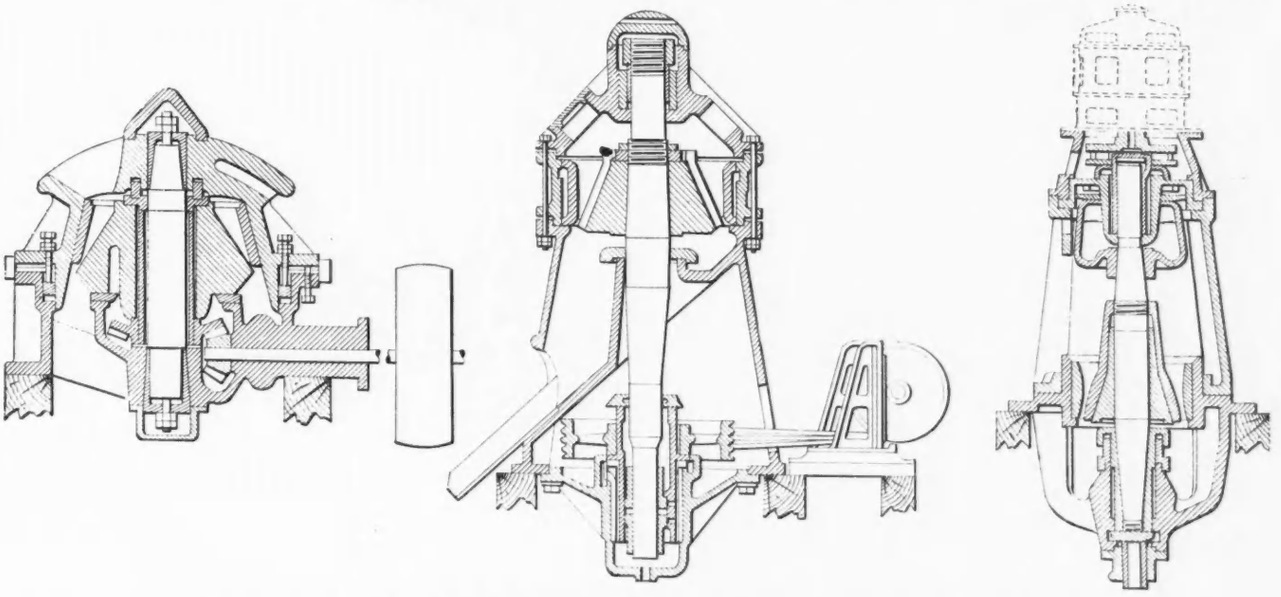


Fig. 5—A coarse breaker modified for secondary crushing by fitting a special short head and reducing the working length of the concaves

very necessary where the width of the aperture was restricted, but the obtuse angle for the head also increased considerably the downward thrust on the main shaft. Length of head and height of crushing zone were very small in proportion to the length of the main shaft, so that the variation in the crushing stroke from top to bottom of the cone was much less than in a machine shows the gearless fine crusher made by the Kennedy-Van Saun Corporation, which was very similar in principle to the Gates Style "H," with the addition of two special features introduced by this company. One of these was the pulley drive for the eccentric in place of the bevel-gear reduction and the other the ball-and-socket movement for the inner bearing of the eccentric.



Three gyratories in which efforts have been made to adapt them for fine crushing

Fig. 6, left—A gearless fine crusher made by the Kennedy-Van Saun Corporation. Fig. 7, center—The Telsmith reduction breaker, a development from the Symons gyratory, with alteration in design to make it suitable for fine crushing. Fig. 8, right—The Weston gyratory, specially designed for secondary reduction of medium-grade stone.

fitted with a longer head. This made it possible to work with a stroke of about five-sixteenths of an inch at the bottom of the cone, and the breaker could be set to crush to half-inch material. This machine was one of the first to be fitted by the Gates Co. with a suspended shaft, and the design for this part shows slight variation from more modern types.

As a result of the efforts to produce a really satisfactory crusher for small material, the Style "H" breaker was made in at least six different patterns, but for a number of years the gyratory as a fine crusher made little or no headway. As a sort of half measure, most gyratory builders suggested that their coarse breakers could be modified for secondary crushing by fitting a special short head and reducing the working length of the concaves as shown in Fig. 5. By these means the width of the feed opening was modified to suit the smaller feed, which had to be limited to prevent overcrowding at the sizing point. The crushing stroke at the bottom of the cone was also reduced so that the head could be set closer to the concaves, and the area of the crushing surfaces was made more in keeping with the extra hard work of fine crushing. Although these changes were helpful, it was not possible to obtain any great output from the smaller machines, and the larger breakers could not be altered to give the three-quarter-inch or finer product which was generally required, so that the modified crushers were used to only a limited extent.

The increasing demand for small stone encouraged the crusher builders to greater efforts, and about 1916 to 1918 a number of machines specially designed for this particular duty began to make headway. Fig. 6 The pulley drive was not novel, as may be seen by referring to Fig. 2, but the Kennedy company found that by its use the revolutions of the eccentric could be considerably increased, and that thereby the rate of crushing could be speeded up. Since the output from any crusher is limited by the area for discharge, it follows that production can be augmented, up to a certain point, by adding to the number of gyrations per minute which open and close that discharge. One of the drawbacks to the gyratory as a fine crusher is the restriction of the area for discharge, and it is possible to overcome this only by increasing the speed of crushing.

The Telsmith reduction breaker, shown in Fig. 7, was a development from the Symons gyratory crusher with alteration in design to make it suitable for fine crushing. It will be noted that in this machine the internal diameter of the concave ring was greater at the outlet end than at the feed point. Theoretically, with equal speed of crushing at top and bottom of the cone, the cross-sectional area of the crushing cavity should be as nearly equal as possible from inlet to outlet if free breaking without packing is desired. This ideal is difficult to attain, but the Telsmith crusher approaches nearer to it than any other form of reciprocating breaker.

From the manufacturers' point of view an advantage is gained by restriction of the feed opening. It prevents stones which are too large in size from being fed to the crusher. A reduction of five or six to one—say from five-inch pieces to a product one inch and under—is quite as much as should be attempted in one operation on a hard rock, and if this ratio be exceeded

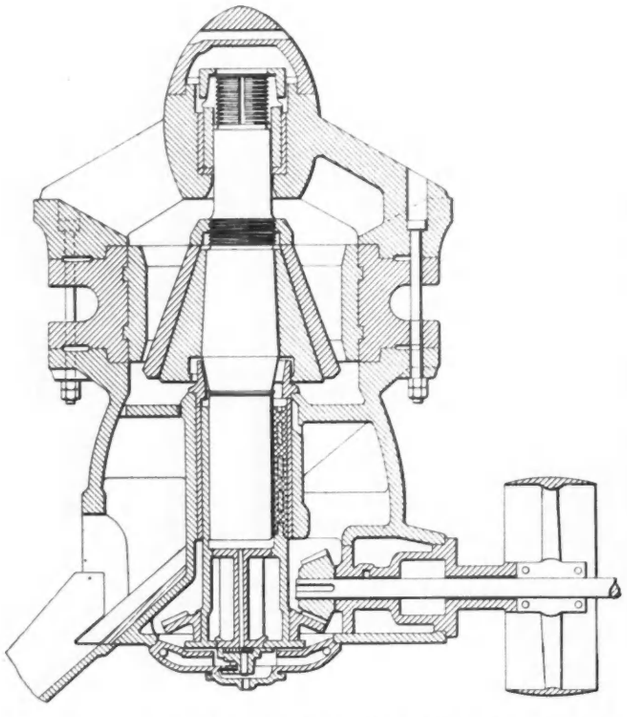


Fig. 9—The McCully fine-reduction gyratory, developed in 1920

the machine is sure to be overworked. Such is human nature, however, that many persons are always ready to try to make a machine do more work than it can safely accomplish. It is therefore well to safeguard the crusher, in both the makers' and users' interests.

The crushing movement in the Telsmith breaker was different from the usual gyratory motion in that the eccentric rotated round a fixed central shaft in a parallel instead of in a conical path. This resulted in an equal crushing stroke for the full length of the head, so that, after fixing the minimum stroke to crush the largest pieces in the feed, this movement was not automatically increased at the outlet point and the head could be set for a smaller maximum outlet opening than the standard gyratory breaker. This Telsmith reduction crusher owes its success largely to a generous system for lubrication, comprising oil pump, storage tank, and piping service.

Another crusher specially designed for the secondary reduction of medium-grade stone is, relatively speaking, a new-comer in the field—the Weston gyratory, shown in Fig. 8. This machine is arranged to give the greatest movement for crushing the largest pieces and the minimum stroke at the outlet end of the cone, and this reversal of the usual procedure is obtained by placing the revolving eccentric in the upper part of the frame, inverting the standard mechanism without changing the position of the crushing head. The shaft is supported on a toe-step with screw adjustment for raising and lowering and so regulating the position of the head. This crusher is arranged for direct drive by means of an electric motor carried on the upper part of the main frame; and the motor is built with a vertical spindle with flexible coupling for attachment to the eccentric. The machine can be fitted with a belt pulley instead of the motor where electric power is not available. The direct-coupled motor gives a high crushing speed, which should give large capacity, and the makers claim that the product turned out is uniform and the sample good.

Illustrated in Fig. 9 is the McCully fine-reduction gyratory, which was developed in 1920. This is a machine of the short-shaft pattern generally similar to the coarse crusher of the same type introduced in 1909 but with alterations to make it better suited for the work of fine crushing. The top shell, or concave casing, was made reversible, and the concaves could be worn at both ends before they had to be removed from the housing. This feature was not entirely novel, as will be seen by reference to Fig. 4, but the construction was simplified by inverting the entire top ring instead of using a separate internal container. With vertical concaves the cone was made to the maximum angle, and the upper and lower edges of the concaves were beveled to give a parallel sizing belt of appreciable width near the exit. The concaves were zincked in place, and, when both ends had been worn, they could be reset to a smaller diameter by using a narrow key concave. This machine was built in two sizes, for products finer than two inch and under, one having a feed-opening six inches wide and the other measuring ten inches at the same point. The former would crush to three-quarters or one-inch size and the latter to one and a half inches and under.

The Traylor Engineering & Manufacturing Co. has also built a series of machines on lines indicated in Fig. 10. These auxiliary crushers were designed to undertake similar duty to that outlined in the preceding paragraphs, and they embodied several special features in gyratory construction patented by this company. The upper shell, which was not reversible, was made with pockets in the top flange to receive the crossbar of the spider. This concave casing was bored to size, and the liners were secured in place by a wedge-shaped key concave fastened by a single bolt. The concaves were not run in with zinc, but, when manganese steel liners were used, hardwood strips about $\frac{1}{4}$ in. thick were placed between the edges at the joints to allow the man-

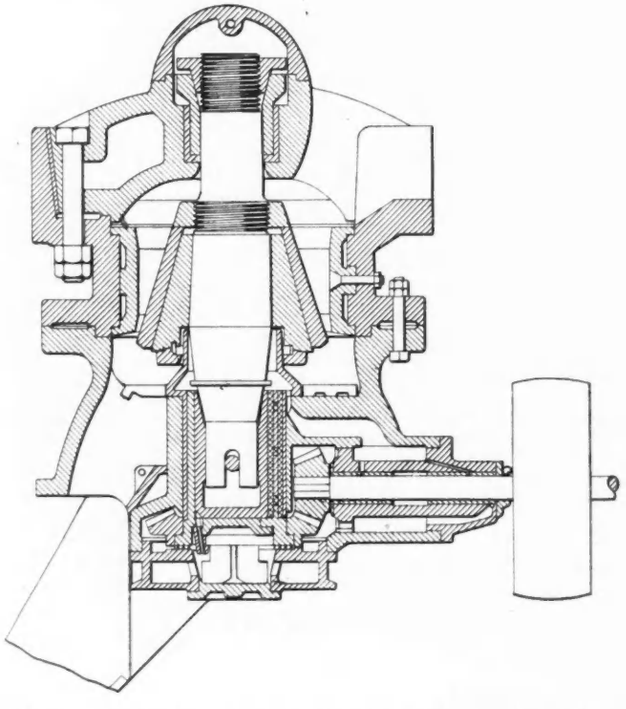


Fig. 10—A series of machines on the lines shown here has been built by the Traylor company

ganese steel to flow freely under wear. The concaves could be removed and reversed or they could be reset by inserting metal shims between the backs of the liners and the casing.

Another interesting feature in the machines just described was the dust seal below the crushing head, which consisted of a cast-steel floating ring supported by a washer plate screwed to the under side of the head. The ring was bored a sliding fit over a bonnet or extension piece secured to the top of the eccentric hub in the lower shell, and the bearing surfaces between head, floating ring, and washer-plate were spherical, the curve being generated from the center of gyration of the main shaft, so that the raising or lowering the shaft could not affect the seal in any way. To increase the output from these secondary crushers they are operated at a higher speed than the primary breakers. Under favorable conditions the gyrations per minute may be increased by 30 per cent above the standard for coarse crushers. It is essential, however, that the lubrication should be ample, as a copious flow of oil is required to lower the working temperature of the eccentric bearings.

The Austin Manufacturing Co. has placed on the market a series of long-shaft secondary crushers with the internal parts arranged as shown in Fig. 11, and in which the eccentric bearings are situated immediately below the diaphragm in the lower shell after a style adopted by this company a considerable number of years ago. These fine-crushers have stronger shafts and larger eccentric bearings than the standard breakers of the same make and have a novel and effective system of lubrication. The gear chamber is flooded with oil and the teeth on the bevel pinion, revolving at high speed, collect a film of lubricant and throw it against the roof or under side of the diaphragm; the oil adheres to the metal surface, and the surplus flows into a trough above and completely surrounding the eccentric. This trough is perforated by a series of evenly spaced holes through which the oil passes to the inner and outer eccentric bearings, the overflow reaching the inner countershaft pedestal.

Fig. 12 illustrates the Symons fine-reduction gyratory crusher, which is the latest entrant in this field of service. At the time of writing this machine is still in its experimental stages, but the principle of operation is so novel that this brief chronicle of the fine-crushing gyratories would be incomplete without some reference to its possibilities and a short description of the mechanism.

In all other gyratory breakers the crushing process comprises reduction by pressure between two confining faces and a subsequent freeing movement during which the material settles by gravity until it is subjected to further pressure and again released. Maximum size of the finished product is determined by the greatest width of aperture at the outlet between the crushing faces, and the stroke or travel of the head has an important bearing on the minimum setting and finest product obtainable. Since the cross-sectional area of the crushing zone decreases as the material settles, there is some tendency for the particles to rub one against the other, and the product is degraded by the fines made by attrition. The Symons fine-reduction gyratory does not break the material by pressure but by impact. In this machine the maximum width of aperture at the outlet has no influence on the size of the product and the amount of travel given to the head is not a deciding factor in arriving at the fineness of the product. This crusher is driven in the usual way by belt pulley and countershaft through bevel gearing to an eccentric journaled in the hub of the spider spanning the lower part of the frame. The gyrating shaft is carried in the bore of the eccentric for nearly

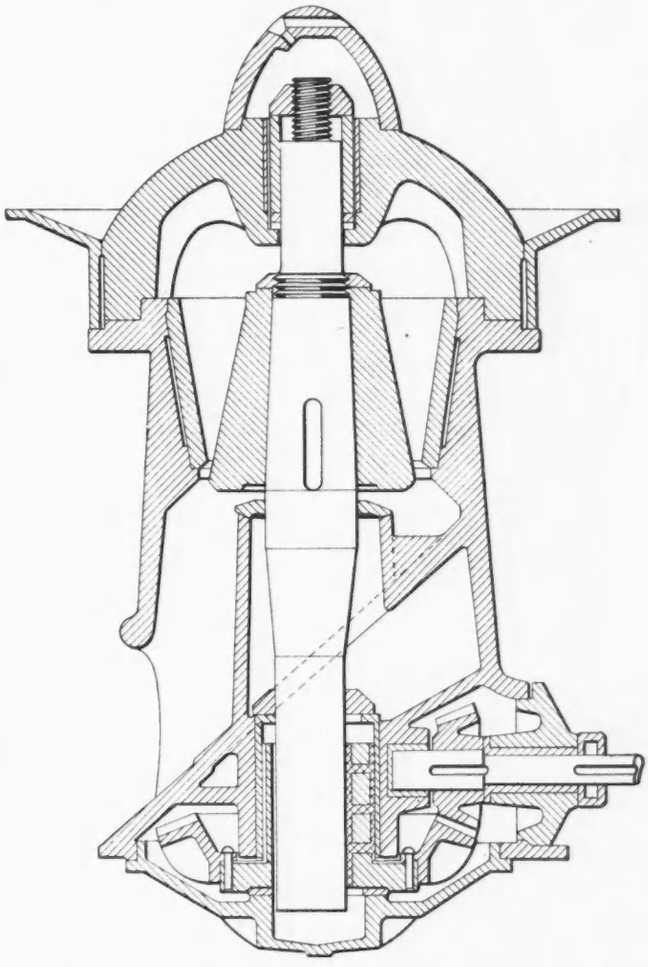


Fig. 11—The Austin Manufacturing Co. has developed a series of long-shaft secondary crushers with internal parts arranged as shown here

half its length and the weight of shaft and head, including a large proportion of the reaction from the crushing force, is supported on a part-spherical seating immediately above the eccentric. No top bearing is provided for the main shaft, but a cap or spreading plate is attached to the upper end of the shaft, which acts as a feeder to distribute the material regularly and evenly into the opening above the cone.

The crushing basin or concave ring is flexibly mounted on a series of long bolts that pass through heavy spiral springs which are seated on an angle ring against the top flange on the upper shell of the machine. This upper section telescopes into the lower part of the body, to which it is secured by strong tie-bolts with double adjusting nuts, and the concave casing, with cushion springs and outer shell, can be raised or lowered bodily to open or close the aperture between cone and concave.

In the new Symons crusher the following sequence of operations constitutes the crushing process: A piece of ore falls by gravity into the space between head and concave and, coming in contact with the cone, it

slides down the surface while the head is traveling toward the concave. This journey is interrupted by a crushing impact, and the broken particles are released to fall once more on the exterior of the cone and be carried forward again until they contact with the outer liners and so complete another cycle of movement. The extent of the free fall and the distance traveled

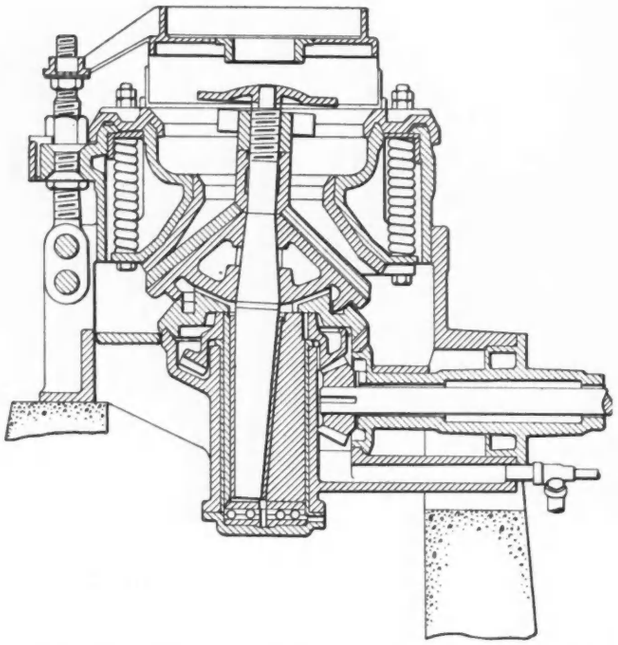


Fig. 12—The Symons fine-reduction crusher, the latest entrant in this field of service

down the cone are naturally dependent on the stroke and on the speed of gyration.

As the material drops down the surface of the head it is free to spread evenly and the area increases in proportion to the extent of reduction, so that, with careful feeding, the particles are not superposed or compacted together during the crushing process, which makes for cleaner crushing. To obtain the free fall which is an essential feature of this process the maximum distance between the concave and the cone is much greater than the ultimate size of the material crushed, and in some cases for a product of one-quarter inch the stroke may be one and a half inches or more.

To insure that little oversize material shall escape through the abnormal opening at the lower end of the cone a parallel zone is arranged of such a width that no particle can evade the final sizing stroke within the period of time occupied in passing through this zone. It follows, therefore, that the size of the finished product is limited by the width of the minimum opening and not by the maximum aperture as is customary. Springs are introduced so that should damp material pack into an uncrushable mass, or a piece of metal enter the crushing space, or in the event of the mantle and concave ring being carelessly adjusted and made to touch, the outer ring may give slightly to the abnormal pressure until the obstacle has been removed. This crusher is still in its infancy, and must pass the test of time. Every new machine of this kind has to have "its corners rubbed off" in the school of hard experience before a really satisfactory product is attained, and its progress will be watched with considerable interest, as the inventor claims that it is capable of making a greater reduction in a single stage than any other machine of its class.

Enough has been written to show that the persistent efforts to make the gyratory crusher a serviceable unit for fine-reduction work have attained a considerable measure of success. In my opinion the gyratory is not so efficient for products under one inch as rolls or disk crushers, for the good and sufficient reason that the only force causing the material to flow through the restricted outlet opening is the acceleration resulting from the attraction of gravity. Rolls have a ribbon flow practically equivalent to the surface speed of the rollers themselves. Disk crushers have a considerable advantage by reason of the centrifugal action of the revolving disks. The fine-crushing gyratory may work well on a hard clean stone, but for any semi-hard or mixed materials it would be well to consider carefully the merits of other types of secondary breakers.

Check System of Paying Employees Meets Approval

The check system of paying employees, adopted by many large industrial concerns in the United States chiefly because of the increase in the number of payroll robberies, is the subject of a special pamphlet issued by the department of manufacture of the Chamber of Commerce of the United States. The investigation, the results of which are summarized in this pamphlet, discloses that payment by check is meeting with general approval, that it has certain advantages over the payment of wages in cash, and that, with minor exceptions, no objection is made to it by the wage earners themselves. It has also been found that the chief consideration that has actuated corporations in adopting the system is not the safety of the payrolls but the safety of employees handling them.

"We were induced to make this inquiry into the paying of wages by check," says E. W. McCullough, manager of the department of manufacture of the National Chamber, in his preface, "not only because of the employer's interest but the interests of the employee and the bank—the three most directly concerned. It also developed that the outstanding factors were safety to life, to property, and the economic considerations which caused the adoption of certain systems. It has been gratifying to note in making this research that the employer has placed the safety of those handling his payrolls—because of bandits, highwaymen, and hold-ups —above all other considerations. Though the handling of large sums of currency has always been attended with risk, this has materially increased since the war and calls for special consideration."

"The Jaw Crusher as a Secondary Breaker"

In the issue of *E. & M. J.* of June 18, in the article carrying the above caption, a statement appears that the Traylor Engineering & Manufacturing Co. makes breakers with a feed opening up to 72x10 in. The manufacturers direct attention to the fact that they make the type of crusher described up to 48x60 in., and say, further, that 72x10 in. is "really a rather small crusher." The opportunity to publish the supplementary information is appreciated.

Some Tin Placer Deposits of Mexico

By Ernest H. S. Sampson
Mining Engineer, Dolores Hidalgo, Gto., Mexico

Ernest H. S. Sampson

COMPARATIVELY little has been published in recent years with reference to the tin placer deposits occurring in various parts of Mexico. In view of the increasingly important part played by tin in American industry and the high price commanded by it on the market, the following contribution to the literature on the subject should be of interest. Tin ore is found in more or less abundance in veins and in placer deposits over a large area in Mexico. This area extends from Ures, near Hermosillo, Sonora, on the north, to Tecali, Puebla, on the south; and from Maiz, in San Luis Potosí, on the east to Mazatan, Jalisco, on the west. In other words, tin-bearing deposits occur throughout a zone having a superficial extent embracing 10 deg. of latitude and 6 deg. of longitude. The general trend of this zone follows the direction of the main axis of the continent in this part. The bearing is approximately N. 40 deg. W.

Deposits of tin are to be found in greatest number in what may be called the middle states—Guanajuato, San Luis Potosí, Aguascalientes, Zacatecas, and Durango. The placer deposits in the State of Guanajuato are those with which I am most familiar, and in this article attention will be confined principally to them.

Exploitation on a small scale of the tin-bearing gravel deposits has been conducted in Mexico since the earliest times, even before the Spanish Conquest.[1] Numerous relics of those bygone days are to be found in many localities in Guanajuato and elsewhere. At El Molino, in the municipality of Dolores Hidalgo, may be seen the ruins of an old Spanish mill in excellent preservation. The motive power was water, which was carried by an aqueduct from a strongly built dam higher up the ravine. The arrangement of the plant was elaborate and ingenious, though the principle involved was simply water concentration of the gravels. Ore from tin veins in the neighborhood, as also mercury ore from a deposit about three miles distant, were doubtless treated in the same plant.

In other localities the ruins of ancient dwellings, "patios," furnaces, and the like bear mute evidence as to the nature of the operations conducted, and prove that those early miners were well aware of the existence of stream tin in the valleys.

While panning samples of gravel along a stream near Obregon, Guanajuato, I found a small silver hand, of antique design, which had apparently been worn as a charm. The same sample contained smelted tin in addition to more than 1 per cent of cassiterite. In other samples the heads of rusted horseshoe nails of a pattern used two hundred years or more ago came to light; and in the same locality broken pieces of tableware made from crude metallic tin were found.

The general trend of the principal central mountain range in Guanajuato is N. 30 deg. W., and it is on the eastern flank of these mountains that the most important tin-placer deposits occur. The gravel deposits, which are in part tin-bearing, extend approximately from the station of Dolores Hidalgo, on the Mexican National Railroad, on the south, to Ocampo, in the Sierra del Pajaro, and San Antonio, in the Sierra de San Pedro, on the north, and have an average width, east and west, of perhaps 10 miles. Their north-and-south extension approximates 50 miles. The maximum elevation at which they are found is at Ocampo, about 8,000 ft. above sea level, and they slope gradually down to the south and east, until at Dolores Hidalgo their altitude is a little more than 6,000 ft.

In many of the valley bottoms an abundant supply of water is found within 6 to 10 ft. of the surface the year around. During the rainy season, usually from May to October, every valley has its running stream. This continues, as a rule, until the end of December, after which water is found only in the deeper pools until about March. In some of these occasionally the water will remain until the rains begin again.

The veins from which the gravel deposits have derived their tin content occur almost without exception in

Sketch map of Mexico, showing the geographical distribution of tin deposits

a rhyolite-porphyry formation containing numerous phenocrysts of quartz and feldspar, of which the Santa Rosa mountain range is largely composed.

On account of the tremendous rush of water down the mountain gulches after frequent heavy cloudbursts during the rainy season, the tin values have in most

[1]Jones: "Tinfields of the World," Chap. IX, p. 309.

Map of Guanajuato, showing the area covered by gravel deposits

cases been carried to considerable distances from their source of erosion. For this reason cassiterite in a fine state of division may be found as far as 5 or 6 miles away from the veins where it originated. In a few instances where the topography favored such a condition the best concentrations of tinstone are found at the foot of the rhyolitic formation close to its contact with the gravel. Generally speaking, it may be said that the principal deposition has occurred within a mile to a mile and a half of the eroded tin veins, a gradual diminution of richness being observed within these limits.

The foothills of the mountain range are composed almost entirely of a strongly cemented gravel or conglomerate in which both angular and rounded pebbles are found. Notable features of this formation are the occurrence of seams of rhyolitic tuff interbedded with the gravel, numerous smoke-blackened "bombs" of rhyolite, and thin flows of rhyolitic lava, varying from as little as 3 or 4 in. up to as much as 2 or 3 ft. in thickness. These gravel banks extend in a series of four benches eastward toward the Mexican National Railroad, which runs from Mexico City to Nuevo Laredo. Starting with high banks in the foothills, deeply eroded to form wide valleys, the bottoms of which are in many instances not less than 400 ft. below the crests of the ridges, the topography gradually becomes less prominent, until finally at a distance of about 10 miles to the eastward a flat plain occurs. This is traversed by deep ravines, or *barrancas*, as they are locally termed, which form some of the tributaries of the Laja River, the principal watercourse of the district.

The occurrence of considerable quantities of clay or hardpan in the flatter part of the country lends support to the supposition that in former times a large lake existed between the eastern and western mountain ranges.

Evidence of the great thickness of the primary or cemented gravel beds is given by the fact that a shaft sunk from a tunnel 450 ft. below the crest of the gravel bank penetrated the same formation to a depth of 135 ft. without reaching the underlying rhyolite.

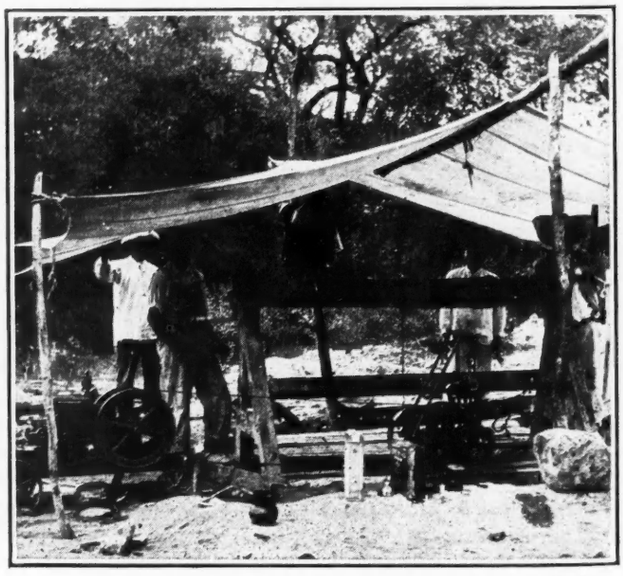
The cementing of the gravel appears to have been caused by the eruption of a series of volcanoes at the time of or subsequent to the formation of the main western mountain chain of the district. The cementing material is undoubtedly volcanic ash, and the pebbles consist of rhyolite in various phases that pass from a glassy to a banded or spherulitic structure. Throughout the entire mass, evenly distributed, is to be found a black powder consisting mainly of specular and magnetic iron, but containing oxide of tin also.

In the course of centuries portions of these enormous gravel banks were eroded away to a depth 50 ft. or so below the present level of the valley bottoms, and a secondary loose gravel deposit was laid down. It is in these secondary gravels that the principal deposits of cassiterite are found.

During the secondary deposition numerous veins of tinstone which had been formed in the rhyolite were evidently eroded away, the nodules and finely divided particles of cassiterite being carried down the gulches by water and deposited in the valley bottoms, where the quieter waters resisted their further migration.

Between the periods when stones were hurled in vast quantities from the craters, or showers of fine dust settled to a thickness of several feet on top of the débris, periods of comparative quiescence evidently intervened, during which flows of rhyolitic lava quietly welled up and spread over the sides of the craters or issued from newly opened vents and fissures. These flows were probably very liquid, as evidenced by the distance to which they are found from their source and by the thinness of the deposit.

Over the entire valley bottom in many cases a stratum of rhyolitic tuff varying from 2 to 10 ft. in thickness is found resting upon the cemented gravel. It may be stated as a general rule that tin values are not found to any great depth in this stratum, though the first few inches are frequently rich in cassiterite. A rather remarkable feature of these deposits is the occurrence in some places of what is called by the natives "burnt tin." This consists of nodules which have the appearance of having been scorched without melting. These are particularly numerous where thick beds of ash occur, and are found disseminated through the mass. Their tin content is considerably less than that of the ordinary stream tin.



An 80-ft. prospect shaft in tin-bearing gravels, Guanajuato. Deep-well pump unwatering the working

The cassiterite is found in sizes varying from the finest powder up to nodules with a diameter somewhat exceeding half an inch. Larger "kidneys" have occasionally been found, but they are of comparatively rare occurrence. The color of the nodules ranges from buff through various shades of brown to kidney color and black, the latter being the most general. Wood tin is by no means uncommon in the district. The nodules almost invariably consist of reniform masses or broken fragments of crystals, and are usually associated with chalcedonic quartz, magnetic and specular iron, and occasionally opal. From time to time in this locality I have found transparent crystals of quartz having the same reniform appearance, evidently after cassiterite.

The percentage of cassiterite found in the gravels is variable. In about one thousand samples taken by myself and weighing on an average 500 or 600 lb. each, the proportion varied from one one-thousandth of 1 per cent up to as much as 1 per cent. This tinstone compares favorably with the product obtained in the Straits. That found in the Sierra de Guanajuato has a specific gravity of from 6.2 to 6.6 and contains 92 per cent oxide of tin, with 4.5 per cent oxide of iron. It is rarely that a sample taken from any of the numerous valley bottoms shows no indications of tin upon being panned, provided the distance from the acid igneous rocks does not exceed 4 or 5 miles.

The depth to which the cassiterite is found varies between wide limits according to locality, the greatest depth being probably 50 ft., and the average 15 to 25 ft.

In the district lying northwest of San Felipe, Guanajuato, on the east side of the road to Ocampo, a rather remarkable occurrence of tinstone is found. This is a purely superficial deposit of cassiterite which is entangled in the holes and crevices of a mass of lava which has flowed over that part of the country. Considerable iron is associated with the tinstone, and the tin content is comparatively low. In the mountains lying north and east of this deposit there are numerous workings following narrow stringers of tin ore in granitic rocks containing abundant crystals of feldspar, which may be classed as syenite. To the west, near the village of Santa Barbara, are old tin mines of some importance. These mines, which were formerly worked by the banker, D. Amilien Lacaud, are said to have a mineralized zone approximately 270 ft. in width, lying between well-marked parallel walls containing clay and oxide of iron. One of these fissures has a width of about 4 ft. and the other 4½ ft. Pieces of tinstone as large as 3½ in. in diameter have been found between the above-described walls.[2]

In the State of San Luis Potosí, in the municipality of Villa de Arriaga, a short distance north of the Guanajuato boundary, there is also a tin occurrence worthy of mention, known as the "Minas de Santiago." The ore found in this locality is of good quality, and is said to produce metal of a high degree of purity on smelting. The veins have a general northerly and northwesterly strike, and for the most part dip west. In the plains below the mountains in which these veins occur are gravel deposits, which hitherto have not yet been prospected. In my opinion it is probable that valuable tin placer deposits may be found in this vicinity.

In the district of Santa Maria del Rio, lying about 14 miles southwest of the city of San Luis Potosí, are also to be found alluvial deposits of tin. Nodules of cassiterite are usually accompanied by hematite and topaz.

J. P. Manzano, a Mexican engineer, referring to the district known as Iglesia del Desierto, northeast of San Luis Potosi, states that in the Ronquillo mine, in San Pedro, the better class of ore contains between 35 and 80 per cent of cassiterite.[3]

In the valleys adjacent to almost all of the primary deposits cited, besides many others not mentioned in this article, stream tin has been washed out of the gravels by the natives for years. The methods used are, of course, extremely primitive, and work has been performed in an intermittent and unmethodical manner. With careful and systematic prospecting of the valleys there is little doubt that comparatively large areas could be found which would prove worthy of investigation.

Although, in the history of tin mining in Mexico, failures have been many, they may be attributed largely, it would appear, to inadequate equipment; it is possible that in the future the dredge may write a new and more profitable chapter.

Utilization of Germanium

Attention is being given to the study of the rarer elements to ascertain whether they or their compounds possess valuable properties. Germanium, a metal and an element of this type, has, in an alloy form with aluminum, been the subject of investigations by Doctor Kroll, who has published his results in *Metall und Erz* for December, 1926. He states that an alloy containing 55 per cent germanium and 45 per cent aluminum melts at 423 deg. C. and may prove useful as a solder for aluminum. Though aluminum can be soldered with alloys containing tin or zinc, the joints fail if exposed to moisture. An aluminum-silicon alloy would from a corrosion standpoint be desirable, but the melting point of these alloys is too high. Because germanium resembles silicon both in its physical and chemical properties, it was to be expected that the germanium-aluminum alloys would show corrosion-resisting qualities and that the alloy should therefore as an aluminum solder be more desirable than any other now known.

Metallurgy of Manganese

Pyrometallurgy is now the only practical method in vogue for extracting metallic manganese from its ores, states the U. S. Bureau of Mines. As manganese is highly volatile at the temperature required to reduce it to the metallic state, smelting losses are extremely high and materially increase the cost of the reduced metal. To produce metallic manganese, the ore must be smelted at a high temperature and a strong reducing action maintained. As this method reduces any iron in the ore, the resultant metal is an alloy of manganese and iron. The Goldschmidt process, which is based upon thermit action, is now used to produce metallic manganese. In it, pure manganomanganic oxide mixed with aluminum is used. The powdered aluminum is incorporated with the oxide and the mixture is brought to the required temperature. The amount of aluminum used is based on the total oxygen content of the purified manganese oxide and is sufficient to produce sesquioxide of aluminum. Other processes for the manufacture of metallic manganese are the J. T. Jones and the Sternberg & Deutsch.

[2] "Boletin Minero," Sec. Ind. Com. y Trab., Vol. XX, No. 1, p. 24.

[3] "Boletin Minero," Sec. Ind. Com. y Trab., Vol. XX, No. 1, p. 26.

Discussion

The Gold Standard and Commodity Price Levels

THE EDITOR:

Sir—Your issue of Nov. 6 contains an editorial on the stabilization of the Belgian franc. Discussion on the effects of fluctuations in currencies, in relation to gold and to general price value, may not serve any present practical purpose, but the subject is always one of interest.

It is commonly overlooked that, though most of the Continental countries have defaulted, as regards their pre-war internal obligations, in terms of gold, all the gold-basis countries have defaulted in terms of real values—including the United States and the various units of the British Empire. Britain and most of her dominions defaulted until 1925 in terms of gold also. It may be maintained that the contract as regards pre-war debts was in terms of gold and that the countries mentioned therefore have performed no act of defalcation. This, however, is not a complete refutation.

That the United States is innocent of any intentional participation in a devaluation process can be agreed. She certainly inflated her currency to meet the demands of the war. Such procedure was practically unavoidable. With regard to subsequent actions, it was she that upheld the value of gold at a level well above the one to which it would have declined but for her absorbing all the gold offered at $20.67 per ounce and concurrenty maintaining the dollar value. The case of Britain is different. Her policy, far from assisting to maintain the value of gold, tended to degrade it. She wished it to decline, so that she could link her currency with it at pre-war parity. She therefore did actually defalcate on pre-war obligations, in that she intentionally assisted in degrading the value of the medium or standard by which those obligations were expressed or measured. This is no criticism of that action. It is simply a statement of a fact apparently not commonly recognized. Her choice, as regards her internal obligations, both nationally and as between individuals, was to defalcate (to the said extent) on pre-war debts or to increase in the same ratio the far greater obligations that had been incurred during war time at the inflated price level. The former was not only the lesser evil and inflicted less hardship and injustice; it was the only practicable course.

In judging the other countries also, such as Belgium, France, and Italy, the monetary circumstances of the war (and immediate post-war) period must be taken into account as well as those pre-war. At the date when the governments were able to consider stabilization, the great majority of existing obligations, both private and national, had been incurred during the period of inflation. The charge against these countries is not that they inflated and maintained the inflation, but that some have failed to stabilize at such level as was feasible and was calculated to serve best the public interests. I read your editorial to mean this, though it enlarges on the hardships of the "rentier" and others who accumulated savings before the war.

In the United States it appears that the price level is now gradually falling. This, however, apparently is a phenomenon of a different order to the inflation mentioned above, being attributable not to manipulations of the currency but to increase in the production of goods. Whether reduction of price level due to that cause creates an injustice to debtors and a detriment to industry is an interesting point. A reduction caused by currency manipulation unquestionably does so. *Prima facie* it would appear wiser, if not necessarily more equitable, to expand currency concurrently with increase of production, keeping price level constant.

Should the price level in the United States continue to fall to a substantial extent, owing to increasing production—which conditions seem to indicate—a serious position for Britain may be created thereby. It would mean a rise in the value of gold and therefore a strain on her gold basis. To meet that strain by an increase in the price level would be at least injurious to her and perhaps calamitous or even impossible. The degree of the strain would depend on her industrial conditions —whether production was materially increasing or not.

Perth, Australia. H. R. SLEEMAN.
May 11, 1927.

Effects of Bichromate in Flotation at the Sullivan Mill

THE EDITOR:

Sir—In the Sullivan mill the effect of bichromate as a flotation reagent is varied, and the following may be of interest:

Mr. Gieser, in his valuable article on flotation reagents and practice in *E.&M.J.* of May 21, mentions that potassium bichromate is used in the Sullivan mill presumably for eliminating pyrite. With the flotation of Sullivan ore it has been found that potassium, or preferably sodium, bichromate has a decided action in making for an over-all improvement in the separation of galena, marmatite (54 per cent zinc, 11 per cent iron), and iron sulphide (pyrite and pyrrhotite).

The practice at the Sullivan mill is to make a rougher lead concentrate of good grade on the first fourteen cells, and to obtain as high recovery as possible on the last four cells. The concentrate from the fourteen cells is cleaned twice, while a middling product is made on the last four cells and returned to the grinding section. To insure high recovery on the middling section the float is highly intensified. The amount of oil required to do this is sufficient to over-oil the following zinc float. Addition of 0.1 lb. of sodium bichromate per ton of ore to the de-leaded pulp corrects this over-oiled condition on the zinc float. Without the reconditioning action of the bichromate the system of operation on the lead would necessarily have to be changed. Experience has shown that both the grade of the lead concentrate and the recovery would suffer by the change.

Bichromate on the rougher zinc float improves both zinc recovery and grade, even with no over-oiling condition from the lead float. The rougher zinc concentrate is cleaned twice and the tailing from this cleaning operation, containing 3.6 per cent lead, 15 per cent zinc, and 45 per cent iron, is re-ground, re-treated, and a lead-zinc-iron separation is made.

The fortunate part of the procedure is that the bichromate does not depress the small quantity of galena that passes into the zinc in the rougher float, but has a delayed depressant action which becomes effective in the zinc cleaning section. Were it to act as a lead depressant in the zinc rougher float, the lead content of the final tailing would be increased.

Results from a 15,000-ton test conducted a short time ago with conditions and reagents as usual and constant except that no bichromate was used, can be summed up by giving the results of the efficiency bonus earned for the five days of the test against that earned for the balance of the month. The efficiency bonus is based on the grade and recovery of the lead in the lead concentrate plus the grade and recovery of zinc in the zinc concentrate. The recovery basis standard changes with the metal content of the feed. During the five "No Bichromate" test days the efficiency bonus showed a decline of 19 per cent.

Sodium bichromate can be designated as a galena and iron sulphide depressant in the Sullivan mill with its present flotation reagents and conditions. The reagents used are given in the following table, which shows the amount of each that is used throughout the mill in treating a ton of ore.

	Pounds per Ton
Water-gas tar	0.4
Cresylic acid	0.4
Coal-tar creosote	0.2
Sodium cyanide	0.2
Sodium carbonate	3.0
Copper sulphate	0.9
Sodium bichromate	0.1
Sodium xanthate	0.06

H. W. POOLE,
Flotation Engineer, Sullivan Concentrator.
Chapman Camp, B. C.

[Mr. Poole's most interesting description of the use and effect of bichromate at the Sullivan mill is timely and an important contribution to our discussion on flotation reagents. The delayed action of the bichromate is particularly worth noting: it does not depress the lead in the zinc rougher machines, but does have that effect in the cleaners. Others who use bichromate are invited to submit briefly their experiences with this reagent; or those who have found other chemicals more useful for this purpose will undoubtedly be willing to tell under what conditions they have been found to work best. Perhaps at no plants in the world are operations more intelligently conducted than at those of the Consolidated M. &. S. Co. in British Columbia, but metallurgical conditions are quite different at other plants, and it is probable that in some mills bichromate would not do at all for the very purpose for which it is so successful at the Sullivan. The presence of marmatite in the ore, for instance, is an unusual condition. Many of the Colorado ores contain marmatite, a fact that has caused much grief; perhaps this report of British Columbia practice will aid in their treatment. The "efficiency bonus" plan is also interesting. What other plants have similar plans, and just how do they function?—THE EDITOR.]

Modifying Reagents in Selective Flotation

THE EDITOR:

Sir—In connection with C. S. Parsons' article, "Selective Flotation," in the May 7 issue and the discussion in the June 4 issue by Homar L. Johnson, I wish to contribute a few remarks on this capricious subject.

My experience with various ores and conditions corroborates in a general way Mr. Parsons' discussion of "Modifying Reagents." Probably the fact that there are a good many exceptions to any generalization on flotation reagent conditions was not stressed enough in the article, but that might have been taken for granted.

I believe that generally the use of lime has very little if any activating quality for the flotation of sphalerite. It is likely that when lime is used it sometimes gives rise to the erroneous impression that sphalerite has been activated, whereas in reality the other minerals (pyrite in particular and possibly galena) have been depressed. I also find when using lime as a reagent in sphalerite flotation, especially large quantities of lime—and 8 or 9 lb. per ton is a large quantity—that generally more copper sulphate is required for the actual activating than when using soda ash or other alkalies.

It is possible to illustrate this point with a good many examples, but they would all be more or less a repetition. The following results taken from recent test work on two foreign ores will serve the purpose:

Copper-Zinc Ore

Test No. 1 using lime for the alkaline reagent in both the copper flotation and the zinc flotation.

	Per Cent Weight	Cu	Zn	Fe	Per Cent of Total Cu	Per Cent of Total Zn
Copper concentrate	11.42	22.36	8.62	....	91.71	8.90
Zinc concentrate	13.68	0.70	55.18	....	3.44	68.22
Tailing	74.90	0.18	3.38	....	4.85	22.88
Heads	100	2.78	11.06	18.6	100	100

Test No. 2 using soda ash for the alkaline reagent in both the copper flotation and the zinc flotation; all other conditions the same as Test No. 1.

	Per Cent Weight	Cu	Zn	Fe	Per Cent of Total Cu	Per Cent of Total Zn
Copper concentrate	11.06	22.15	6.15	....	88.92	6.20
Zinc concentrate	18.78	1.14	51.00	....	7.77	87.28
Tailing	70.16	0.13	1.02	....	3.31	6.52
Heads	100	2.76	10.97	18.6	100	100

Lead-Zinc Ore

Test No. 1 using lime for the alkaline reagent in both the lead and zinc flotation.

	Per Cent Weight	Pb	Zn	Fe	Per Cent of Total Pb	Per Cent of Total Zn
Lead concentrate	1.80	40.00	17.50	....	49.84	2.34
Zinc concentrate	23.70	1.80	50.80	....	29.53	89.37
Tailing	74.50	0.40	1.50	....	20.63	8.29
Heads	100	1.44	13.47	33.1	100	100

Test No. 2 using soda ash for the alkaline reagent in both the lead and copper flotation; all other conditions the same as Test No. 1.

	Per Cent Weight	Pb	Zn	Fe	Per Cent of Total Pb	Per Cent of Total Zn
Lead concentrate	2.22	46.10	15.00	....	70.85	2.42
Zinc concentrate	23.54	1.00	52.60	....	16.30	90.02
Tailing	74.24	0.25	1.40	....	12.85	7.56
Heads	100	1.44	13.75	33.1	100	100

As regards the use of soda ash, I have tested a number of ores in which the pyrite flotation was improved by its use. Usually, however, its benefits are more apparent than real. It usually gives a better looking pyrite mineral froth, and occasionally the assays show a better recovery of iron.

In the testing of ores containing large quantities of pyrrhotite, I have found that copper sulphate has a decided activating effect on the pyrrhotite, especially if some means are not taken for depressing the mineral previous to the addition of the copper sulphate.

LIONEL E. BOOTH,
Metallurgist, The General Engineering Co.
Salt Lake City, June 10, 1927.

News of the Week

Summary

RESEARCH WORK of the Bureau of Mines is not to be curtailed. Volume of communications reaching the Bureau indicates that fear exists in the mining industry that the economic functions of the Bureau are to be featured at the expense of its technical activities.

Considerable disappointment is expressed by the gold mining interests of Australia at the tenor of the report by the technical committee of the Development and Migration Commission.

Dr. R. Krahmann, professor of applied geology at Berlin University, will accompany the Elbof geophysical survey group on its mission to New Zealand.

Montana receivership of the North Butte Mining Co. is discharged and the property restored to the former management.

A discovery of gold within twenty miles of Melbourne, Australia, at Bolindale, near Donnybrook, is attracting attention.

Heavy buying by London in Johannesburg of platinum shares is said to indicate the formation of a platinum syndicate to control the output. Another find of alluvial diamonds is made in South Africa near the mouth of the Kei River in the Cape Province.

Russo-Asiatic states metallurgical tests on Mount Isa ores are satisfactory. Capacity of the washing plant at the Villemagne lead-silver-zinc mines, in southern France, is to be increased to 180,000 tons per annum.

Inspiration Consolidated Copper Co. curtails its operating force as a result of unsatisfactory copper market conditions.

Fire breaks out in the Quincy mine, in the Michigan Copper district, but is not expected to interfere with operations.

English interests plan to develop lead-zinc and iron properties in Morocco adjoining the French-owned Rif mines.

Vacas Mining Camp Being Rehabilitated

San Nicolas Company to Increase Mill Capacity to 500 Tons—New Exploration Planned—Large Tonnage of Ore Available

By Alberto Terrones Benitez
Special Correspondent, Mexico City, Mexico

THE VACAS MINES are situated in the Parrilla mining district, State of Durango, Mexico, 15 kilometers west of the Vicente Guerrero station on the Cañitas-Durango railroad branch, which is 89 kilometers from the city of Durango, about four kilometers southeast of the town of Parrilla, and is located at the edge of the Poanas agricultural valley and has an altitude of 2,050 meters above sea-level. Protection of the camp is afforded by federal government troops and "agrarista" volunteers.

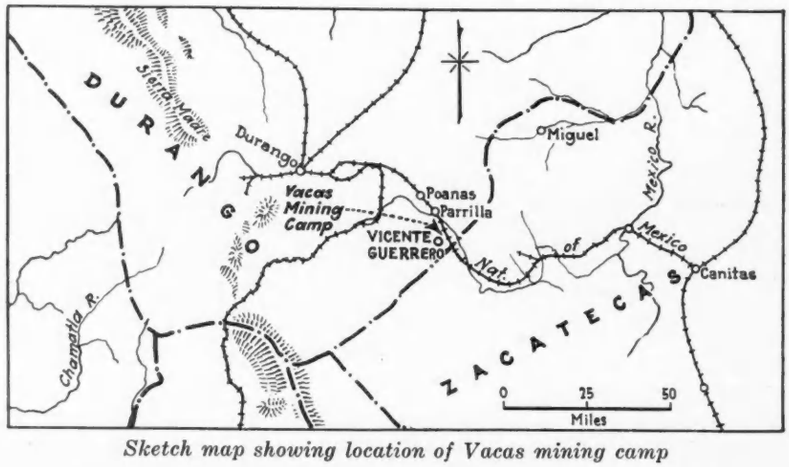
No records of the early history of the camp have been found; the mines are old and seem to have been worked by the Spaniards soon after the Conquest. Available data since 1889 show a total production of 10,000,000 oz. of silver, besides a large tonnage of lead secured by smelting in old-fashioned furnaces using charcoal as fuel.

In 1901 the Quebradilla Mining Co. shipped thirty-eight carloads of ore, totaling 998 tons, averaging 2.5 kg. of silver per ton, 8 per cent lead, and 8 per cent zinc. In 1902, thirty-one carloads of ore were shipped, a total tonnage of 758 tons. The silver content of this ore ranged from 1 to 2 kg. per ton; lead averaged 10 per cent and zinc 10 per cent.

The Quebradilla Mining Co. and the Vacas-San Marcos Mining & Milling Co. operated in the camp about thirty years ago under a joint management. This arrangement failed in 1906 as a result of mismanagement, and operations were suspended. In 1925 the Compañía Minera de Vacas y Anexas, S. A., a Mexican corporation, was organized. It took over all the properties of the two companies mentioned.

At present the San Nicolas Mining & Milling Co., S. A., another Mexican corporation, owning forty-two pertenencias of valuable mineral ground in the camp, is operating under a lease-and-option agreement, the following claims, compromising 149 pertenencias, of the Compañia Minera de Vacas y Anexas, S. A.: San Nicolas, San Geronimo, El Cuervo, La Filipina, California, Las Vacas, San Marcos, Demasias de San Marcos y Vacas, Ampliación de San Marcos, Segunda Ampliación de San Marcos, Las Becerras, Vacas No. 1, Tercera Ampliación de San Marcos Demasías de Vacas, Iñez, Purísima de Quebradilla, Los Michosos, El Tesoro, El Misterio, and Detroit. Besides these holdings the Vacas company owns several hectares of surface rights, a 300-ton mill with 400,000 tons of tailing, several ore dumps, numerous mine buildings, and the right to use the water of the near-by Graceros River.

The present management has undertaken the rehabilitation of the Vacas camp. H. O. Tucker is president of

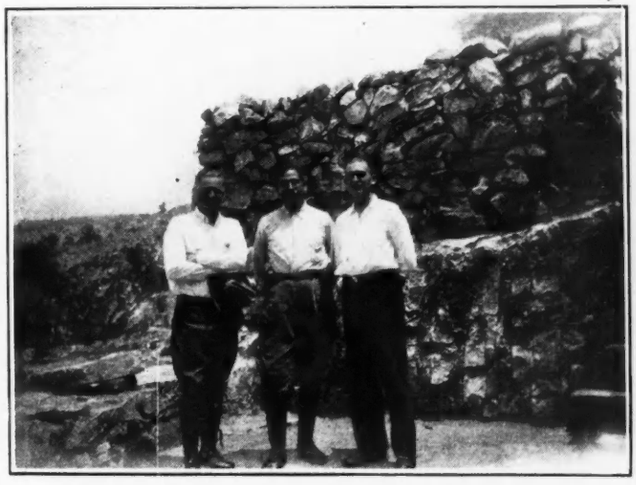


Sketch map showing location of Vacas mining camp

Two-compartment shaft of the Recuerdo mine

Quebradilla mine, Consuelo mine in the background

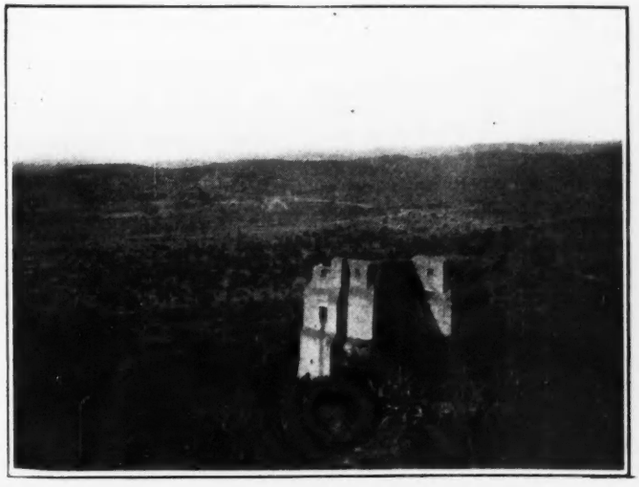
In the Vacas Mining Camp,



H. B. Hanson (left), Alberto Terrones Benitez (center), and H. O. Tucker (right)

Surface plant at the Vacas mine of the San Nicolas Mining & Milling Co.

Near Parrilla, Durango, Mexico



San Marcos mine, old fortress in foreground

Old pump plant on the Graceros River

the San Nicolas Mining & Milling Co.; H. J. Moffet, vice-president, and F. L. McCaughan, secretary. It is intended to operate on an extensive scale, using modern methods of mining and ore dressing. In the management of operations Mr. Tucker is assisted by H. B. Hanson, a graduate of Minnesota University. Moffet & White, Inc., a firm of Los Angeles, Calif., have been handling the financing of the Vacas camp through the Latin-American Milling Co., which owns 60 per cent of the stock of the San Nicolas Mining & Milling Co., S. A.

A 400-hp. Diesel engine is being installed at the mines. This new power plant should result in a saving of $60,000 a year, besides insuring steady operations. The modern machinery at the mill includes a 40-cell Kraut flotation plant, No. 56 Marcy ball mill, Dorr classifier, Oliver filter, belt conveyors, and Wilfley concentrating tables. The capacity of the mill is to be increased to 500 tons per day.

El Recuerdo group of mines, adjoining the Vacas mines to the west, is now being operated by an independent company under the management of Charles E. Snider. These mines are the property of the North American Lead Corporation of New York City.

The Vacas camp is characterized by a typical sedimentary formation of the Cretaceous period (Vraconiano?) which, probably during the early Tertiary (Eocene) was subjected to very intense folding, followed by fracturing and faulting. This is evidenced by intrusions of igneous masses of the andesite-diorite series in the form of dikes. Near the dump of the Quebradilla mine the sharp bend of a closed fold is visible, and it suggests the existence of a pitching anticline, the axis of which bears more or less N. 20 deg. W., dipping to the north. At its highest portion, the crest of the anticline has been completely eroded, and the strata constituting one of the limbs of the closed fold dip from 65 deg. E. to nearly vertical. The general trend of the strata is more or less that of the axis of the fold.

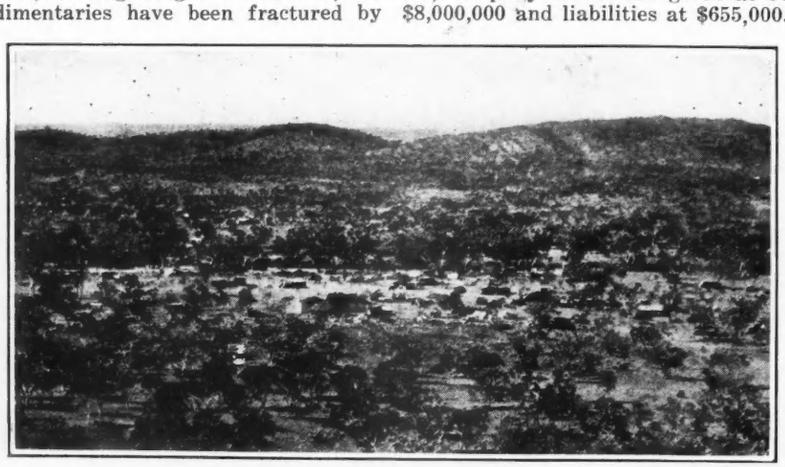
The igneous dikes cut the Cretaceous formation at right angles to the strike of the strata. Mineralization is found in the contact zones, and it also penetrates along the strata for great distances, forming irregular orebodies; the sedimentaries have been fractured by the intruding dikes in criss-cross directions, and regular "chimeneas" or chimney ore deposits were formed. It was through "chimneys" of this kind that the Vacas, San Marcos, and Quebradilla mines were discovered and worked to an average depth of 200 meters. They are all flooded to a depth of fifty meters and part of the upper workings have caved. A considerable amount of milling ore was left in the mines, which examining engineers have estimated to be 250,000 tons in sight.

The management of the San Nicolas Mining & Milling Co. intends to undertake new exploration work by crosscutting the sedimentary formation, as it has been found that in early mining operation large orebodies along the strata were missed by lack of lateral development. Incidentally, a large tonnage of milling ore left in the old mines will be hoisted out for treatment.

The ores consist of a galena, zinc blende, and iron pyrites. Gangue material is chiefly calcite produced by the recrystallization of the limestone in the contact and mineralization zones. The calcite also shows signs of silicification in the richest parts of the ore deposits.

Montana Receivership of the North Butte Discharged

Federal Judge Bourquin, acting on his own motion that no occasion exists for such proceedings, has discharged the Montana receivership of the North Butte Mining Co. and restored the property to the management before receivership. Paul A. Gow, general manager, has again taken charge of the property. Judge Bourquin criticized the action of the receivers in filing their primary suit in Minnesota, saying there was no occasion for it, as all of the properties of the company are in Montana. Receivership was granted on a secured claim for $6,500, and the court stated that when the bill for receivership, costs, expenses, and compensation comes in, it will amount to many times the small claim on which receivership was granted. The court did not rescind or annul the order appointing the receivers, although it had the right to do so; instead, the receivers were discharged and given ten days to report. In a report issued by the Butte stockholders' protective committee, company assets are given at over $8,000,000 and liabilities at $655,000.



The Mount Isa district in Queensland, Australia

Russo-Asiatic Chairman Presents Facts on Mount Isa Deal

Leslie Urquhart, chairman of the board of directors of the Russo-Asiatic Consolidated, Ltd., in referring to the company's recent acquisition of a controlling interest in Mount Isa Mines, Ltd., stated: "We are providing Mount Isa with the funds necessary for the rapid development of the business by the purchase of 550,000 shares for £550,000, and in addition we have an option for two years to purchase a further 200,000 £1 shares at £2 per share. The company remains Australian, the Russo-Asiatic Consolidated have an equal representation on the board with the nomination of the chairman in Australia, and we have also been appointed consulting engineers in control of the technical management.

"As to the present magnitude and future promise of this great mining property there can be no doubt. Underground development work to an average vertical depth of 200 ft. as at Dec. 31, 1926, had reasonably proven about 4,000,000 tons of carbonate ores, and the promise held out by these developments has been confirmed by the results of the first diamond-drill holes completed into the sulphide zone on only two of the several existing orebodies. On the Rio Grande at an approximate depth of 500 ft. about 40 ft. of sulphide ore was cut assaying some 17 per cent lead and 19 oz. silver per ton, and a second borehole on the Black Star orebody, also at about the same depth, cut sulphide ore as follows: 39 ft. assaying 10 per cent lead, 14.3 per cent zinc, 5.3 oz. silver, followed by 115 ft. assaying 5.8 per cent lead, 9.7 per cent zinc, 3.7 oz. silver, followed by 10 ft. assaying 7 per cent lead, 12.6 per cent zinc, 5 oz. silver, followed by 35 ft. assaying 7.7 per cent lead, 11.4 per cent zinc, 5.3 oz. silver, representing a horizontal width of 183 ft.

"We are thoroughly satisfied from the result of preliminary tests that the ore presents no serious treatment difficulties, and as to its profitable value there is no question.

"The immediate program embraces an extensive diamond-drilling campaign to prove the sulphide ores at depth and underground development in the carbonate zone. We are also undertaking treatment tests on the various classes of ore, and at an early date shall proceed with the erection of a pilot mill on a commercial scale."

Moctezuma Copper Co. Employees Establish Safety Record

What is believed to be a new mine safety record has been established by the more than 1,800 employees in all departments of the Moctezuma Copper Co., of Nocozari, Mexico, who worked the entire month of May with no time lost resulting from injuries received while on duty. Employees of the underground department of the Moctezuma branch of the Phelps Dodge Corporation had previously worked an entire month with no time lost through injuries, but May was the first month in which employees in all departments achieved such a record.

Inspiration Consolidated Copper Curtails Operating Forces

United Verde Copper Company Offers Funds to State of Arizona to Complete Highway Section

During the last week the Inspiration Consolidated Copper Co. laid off approximately 400 men, as a result of "unsatisfactory conditions in the copper market." Most of these men were employed in the concentrator and underground departments. The total underground force at Inspiration during ordinary operations ranges between 600 and 700 men, but a great many additional men are employed in the mill, smelter, and other surface plants. It is estimated that the curtailment will reduce the total force to about 2,000 men. The following announcement was made by the company:

"In view of the unsatisfactory conditions existing in the copper market, the Inspiration Consolidated Copper Co. has found it necessary to further curtail operations.

"The directors and officials of the company deeply regret the necessity of this step, but it is forced upon the company by circumstances beyond its control."

The Horse Mesa Dam, on the Salt River north of Phoenix, Ariz., has been completed and its power plant is generating electricity at the rate of a million dollars' worth of current per year. The lake formed by the dam reaches almost to the Roosevelt Dam, and places under water two miles of the Apache Trail. Traffic over this highway has been stopped until a new stretch of road can be built. The state highway department has no money, so the United Verde Copper Co. has offered to advance the necessary $60,000 which the work will cost, the mining company deducting this amount from its next tax payment.

The Miami Commercial Co., operated by the Miami Copper Co , on a co-operative basis, expects to distribute profits amounting to $40,081.80 among its employees some time in July. The distribution is said to be equivalent to 14.78 per cent of purchases made by participating employees. Semi-annual distributions of profits have been one of the company's polices for the last eight years.

The Clark Memorial Club, at Clarkdale, Ariz., was recently formally opened by appropriate dedication exercises. The club house was erected through the expenditure of a fund of $100,000, which was set aside for the purpose in the will of the late Senator W. A. Clark. Membership is open to employees of the United Verde Copper Co. The building is Spanish in architecture and is built of hollow cement tile covered with cement plaster. The roof is Spanish tile. Four main rooms, the auditorium, men's and women's lounges, and the library, comprise the lower floor. Facing east is a veranda running practically the full length of the building and giving an excellent view of the lower town, the river, Peck's Lake, and the distant mountains. In the lower part of the structure are the bowling alleys, change rooms, heating plant, and custodian's quarters. The building is furnished in solid American walnut and tapestry. The monogram "W.A.C." has been used effectively on the curtains, desk sets, and fire screens. Hammered copper has been used in many places. A bronze memorial tablet, engraved with the name of the donor of the building, was unveiled at the dedication.

Most of the active mines and prospects, both large and small, of Mohave County, Ariz., are continuing operations through the summer, although it is hard to retain experienced miners during the hot weather. A. B. Richmond, ore buyer for the Magma Copper Co., has been paying the district a visit. The Superior smelter is in the market for ores that can be mixed with the ore from the Magma mine.

At Chloride the Chloride Mining Co. is operating its new mill at capacity, and has increased its force of miners at the Hidden Treasure mine.

Shaft sinking at the Dardanelles mine has reached the 300 level. A group of Portland men are financing some development work at the Schenectady.

News From Washington

By PAUL WOOTON
Special Correspondent

Economic Work of Bureau of Mines Not to Interfere with Technical Activities

Particular Attention Being Given to Research—Present Metallurgical Needs of Industry to Be Considered—New Mine Rescue Car Ordered

JUDGING from the many communications reaching the U. S. Bureau of Mines, some fear exists in the minds of mining men, both in the metal-mining and coal-producing branches of the industry, that the economic work of the Bureau is to be featured at the expense of its technical activities. This is not the fact. The greater proportion of the Bureau's present work is along technical lines.

Much has been said in this correspondence and elsewhere about the Bureau's economic work. This seems to have created the impression that a large amount of activity in the investigation of economic problems is going forward. As a matter of fact, funds for economic studies have been forthcoming very slowly. Secretary Hoover has been anxious to see more work of that character initiated if it could be done without interference with the technical work. The effort to persuade the Director of the Budget to allow money for that purpose has aroused much discussion both in and out of Congress. For that reason, the economic work has been much in the news. Incidentally, it is understood that Senator Oddie's activities last year have borne fruit, and that the probabilities are that the increased appropriation which he urged last year will form a part of the next budget.

The technical work of the Bureau, as a matter of fact, is being pushed more actively than ever before. Particular attention is being given to research work. A. C. Fieldner, who is regarded as particularly capable in the administration of research, plans to strengthen those activities materially He will soon start on a trip during which he will visit most of the experiment stations on that mission. This trip will include attendance at the Salt Lake City meeting of the American Institute of Mining and Metallurgical Engineers, where he expects to get the views of many Western mining men as to the present needs of the industry in metallurgical and other research.

The Bureau has perfected a working organization to stimulate research and experimentation in ferrous and non-ferrous metals, in ore dressing, and in the non-metallics, by placing a group of experts under Mr. Fieldner in each of these lines. O. P. Ralston, the assistant chief metallurgist of the Bureau, is to be in charge of non-ferrous metallurgy; C. H. Herty, Jr., ferrous metallurgy; W. H. Coghill, ore dressing; and Oliver Bowles, non-metallics.

The program for the health and safety branch of the Bureau during the fiscal year which began July 1 is more comprehensive than ever before. This happens to be the part of the Bureau's work that is best known in the East. The new mine rescue car for which appropriation was secured at the last session of Congress has been ordered. With one more rescue car, which it is hoped to obtain this year, the Bureau will have ten steel coaches in serviceable condition.

Though the failure of Congress to provide funds has made it necessary to close down the Bureau's oil-shale plant in Colorado, a limited supply of shale oil produced under known and controlled conditions is available for the use of commercial refineries for experimental purposes.

A new problem to be undertaken by the Bureau if funds can be found deals with the better utilization of natural gas. Much gas is now being wasted, particularly in the West, because there is no way in which it can be made to earn a return. If some means could be devised to develop a synthetic motor fuel from that source, the public benefit would be great.

The American Zinc Products Co., of Greencastle, Ind., has filed a complaint with the Interstate Commerce Commission against a rate of 36½c. on shipments of zinc sheets, plates, and strips from Greencastle to Madison, Wis. It is contended that the rate mentioned is unreasonable and prejudicial. The establishment of just and reasonable rates is asked.

Melbourne Letter

By Peter G. Tait
Special Correspondent

Tenor of Commission's Report Is Disappointing to Gold-Mining Interests

Melbourne, June 15 — Considerable disappointment has been expressed by the gold-mining interests at the tenor of the report by the technical committee of the Development and Migration Commission. The prime minister, S. M. Bruce, states that nothing will be done until a further report is furnished by the commission. F. R. Lee, of the gold producers' committee, which has been fighting for a bonus on gold for several years, points out that while British and foreign manufacturers are being encouraged to invest capital in establishing their industries in Australia, and receive a subsidy by way of a protective tariff or bounty, mining investors are treated quite differently. Gold mining is in its present position largely because of the policy of the country, which has increased the cost of all machinery and supplies, as well as wages. The claim of the mining companies is that had they been permitted to benefit as other metal producers were, from the high prices ruling during the war period, money for mine development and remodeling of treatment plants would have been available. The advocates of the bonus on gold claim that it is just as reasonable to give assistance to gold mining, which has done so much in promoting settlement and adding to the wealth of the country, as it is to assist the sugar industry, or the iron and steel industry. Gold mining is the only industry that is endeavoring to pay its way with prewar prices for its product in the face of high post-war costs.

A discovery of gold within 20 miles of Melbourne is attracting attention, and it is interesting to remember that one of the earliest Victorian gold fields was quite close to the metropolis—at Warrandyte, on the Yarra River. Large quantities of alluvial gold were won, and when that was exhausted attention was directed to the reefs. Several companies were fairly successful, and even today more or less spasmodic operations are carried on in the district. The present find is on the other side of Melbourne, at Bolindale, near Donnybrook. A crushing of sixteen tons yielded 93 oz. of fine gold. Mr. Baragwanath, director of the Geological Survey, says that the find is proof that all easily won gold in Victoria has not been exhausted, and he considers the prospects encouraging.

A rich gold-bearing lode has also been uncovered about 7 miles from the once-famous Pambula gold field, in New South Wales. Sufficient work has not been done to indicate the full importance of the lode. A large area of ground has been pegged and several samples are being shipped for treatment.

Prospecting for tin is being actively pursued in many parts of Australia. Tin occurs and has been profitably worked in all the states of the Australian Commonwealth, except South Australia. Prospecting at the moment is most active in Queensland and the Northern Territory. It is reported that London interests have acquired an area on the Tabba Tabba cattle station, near Port Hedland, in the northwest of Western Australia, which was favorably reported on by Campbell Shaw. Adjoining areas have been taken up by other syndicates.

J. B. Jaquet, Chief Inspector of Mines for New South Wales, recently visited the Grawin opal field, situated about 43 miles northwest of Walgett. The area now being worked is only a few hundred yards from the shafts sunk when the field was first worked about eighteen years ago. The formation is identical with that in which precious opal occurs at Lightning Ridge and very similar to that occurring at the famous White Cliffs opal field. From 150 to 200 men are at work in the field; some have done very well, others have only made wages, and a number have been unsuccessful. It is impossible to obtain any accurate information as to the value of the production. There is no difficulty in disposing of first quality opal, but the poorer grade is hard to sell.

Dr. W. G. Woolnough, of Sydney, has been retained by the Commonwealth Government for a period of six months to advise in regard to oil prospecting in Australia and New Guinea. The Commonwealth Government is subsidizing boring operations on four areas in Australia.

Dr. R. Krahmann, professor of applied geology at Berlin University, and the principal of the council of scientists who advise the Elbof Geophysical Research Organization, has cabled to the secretary of the Coal, Oil (N. Z.) Ltd., Sydney, that he has decided to accompany the Elbof survey group on its mission to New Zealand to make a complete geophysical examination of the company's Waipatiki oil field. The party is expected to arrive in New Zealand during August next. It is understood that Dr. Krahmann proposes to deliver a series of lectures on geophysical research before Australian scientific societies.

Tonopah Production Shows Little Change in June

Production of the Tonopah, Nev., district for June was practically the same as for May, bullion shipped being valued at $157,800. Of this total the combined bullion of the Tonopah Mining Co. and the Tonopah Belmont Co. was valued at $77,000; that of the Tonopah Extension at $58,800; and that of the West End Consolidated at $22,000. No developments of importance were reported in June, and it is not likely that figures for July production will differ materially from those of June.

The West End Consolidated Mining Co. has shipped lots 70 and 71 from its Mabel mine, situated about 20 miles west of Mina, Nev. The ore was stoped from the 500 and 300 levels. The average grade of the 71 cars shipped from this mine is around $120 per ton, in silver, gold, and lead, the principal values being in silver and gold. The vein seldom exceeds 2 ft. in width.

London Letter

By W. A. Doman
Special Correspondent

English Interests to Develop Properties Adjoining French-Owned Rif Mines

London, July 5—For many years past the French-owned Rif mines of Morocco have been producing large quantities of iron and lead and paying good dividends, and adjoining properties are now to be further developed by an English undertaking. These areas, which have not hitherto been worked below water level, have been favorably reported upon by W. H. Rundall, of the firm of Pellew, Harvey & Co., and are now being acquired by the European and North African Mines. Development at depth is being undertaken, and up-to-date plant and electric power are being installed. The lead-zinc ore is of good quality, and about seventy-five tons monthly is being produced. There is an estimated reserve of over 500,000 tons of iron ore, which contains some manganese. With the opening up of the deposits at depth, the output and reserves should be greatly increased. Sir Frederick Mills, chairman of the Ebbw Vale Steel, Iron & Coal Co., is chairman of the new concern, and two Rif directors are on the board.

Reference was made last week to the acquisition by the Russo-Asiatic Consolidated of the Mount Isa Mines, of Queensland, and at the recent meeting of the former, Leslie Urquhart was able to add considerably to our knowledge of this big silver-lead-zinc deposit. The short interests in the market here, in an endeavor to belittle the undertaking, are recalling the fact that the Baillieu group, of Barrier, N.S.W. fame, turned the proposition down some years ago. However, metallurgical practice has made great strides in the interim, and tests of the carbonate and sulphide ores, of which there are enormous quantities, have satisfied the technical staff of the Russo-Asiatic. Another important interest of the Russo-Asiatic mentioned in this column several weeks ago—the Villemagne lead-silver-zinc mines of southern France—is turning out well. Developments have proved so satisfactory that it has been decided to increase the washing plant to a capacity of 180,000 tons per annum, there being 3,000,000 tons of ore developed. On this basis the output should be worth 18,000,000 francs per annum with lead at £25 per ton and zinc £28 per ton.

On Friday last the market in Ashanti Goldfields broke rather badly on a misunderstanding regarding the latest development cable giving the value of the Obuassi shoot as only 5 dwt. in the No. 22 level. This was taken to refer to the recent rich strike on the Cote d'Or shoot, which is an entirely separate reef and which was first encountered in the No. 22 level, where it was 56½ ft. wide and assayed 30.9 dwt. per ton. This new orebody was subsequently cut on the No. 21 level, at which point it was 34 ft. 9 in. wide and assayed 2 oz. 6 dwt. per ton. The next point of attack is the No. 20 level.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Sylvanite Operations Better Than Anticipated—Noranda Ahead of Schedule

Toronto, July 16—Preliminary operations of the Sylvanite mill, in Kirkland, are better than anticipated. During June it was expected that the mill would treat ore of a $6 grade, but the recovery for that month was $8.33 and production was more than $40,000, the average being 160 tons a day. During July the mill has been treating approximately 200 tons a day, with the grade a little higher than in June. At present a considerable part of the tonnage is coming from the surface dumps, and when these are cleaned up the grade should show a fair increase. Underground developments continue to be encouraging and on the 1,500 level widths of ore up to 19 ft. have been encountered.

The Wright-Hargreaves mine is getting a great deal of new ore both east and west of the old workings. About 1,200 ft. from the Lake Shore boundary line a fault cut off the ore, but this has been picked up west of the fault, and ore is being opened up on three different levels. On each, 200 ft. of driving averages ore over $20 across a width of 5 to 6 ft. East toward the Sylvanite boundary, and on the south vein, good results are also being obtained. A considerable extension of the vein has been developed, giving an average of about $15. This new ore at both ends is being found below the 1,000 level.

Within a few weeks the Lake Shore will be opening up the 1,200, 1,400 and 1,600 levels, and, if developments on these correspond to the upper levels, it is quite probable that the company will consider plans for further mill expansion. A series of raises are also being connected which will provide another shaft and simplify operations. An underground crusher, which is being installed below the 1,400 level, will handle all ore from, and below, the 800 level.

At the Crown Reserve property, in Larder Lake, which was recently reorganized and re-financed, two diamond drills are operating. One drill is working from the 800 ft. level; the other drill is on the surface. The company has a considerable tonnage of low-grade ore developed, and the prospects for the discovery of new ore are considered encouraging.

In the Quebec field a new company known as the Aldermac Mining Corporation is being formed to take over the Alderson-MacKay mine. The shaft of the mine is down 430 ft. and is being sunk in ore. Diamond-drill holes are being put down to a depth of 1,000 ft. in an effort to locate the same ore, but the objective has not yet been reached.

Diamond drilling from the 300 level of the Noranda is understood to have encountered new ore of high grade and carrying high values in gold. The company is not yet in a position to make a statement regarding this discovery, but it is understood that widths of 25 to 30 ft. are indicated. During the last few months several discoveries of considerable importance have been made by Noranda, and with the completion of the shaft to the 600 level, development of the property should be rapid. The construction program is making good progress and is ahead of schedule.

At the Jay copper property, which lies to the north of the Rouyn district, the crosscut from the 325 level has located the copper orebody, which was proven on the 100 and 200 levels. Ten feet of ore has been encountered, and it is understood that the grade is quite satisfactory. On the 200 level the oreshoot was proven for a distance of 225 ft. and a 30-ton car of ore gave results of 5 per cent copper and 2 oz. of silver.

The Harvie Mining and Exploration Co. is interested in the formation of the Exploration Co. of Canada, which will explore 2,000 acres held under option in the lead-zinc district of Gaspe; will prospect 20 square miles in Cape Breton for lead and zinc; will operate one gold and one silver prospect in Ontario; and will maintain five Ontario prospecting parties and a Quebec prospecting organization.

During June the Keeley Silver Mines, of South Lorrain, produced 101,339 oz. of silver and 10,550 lb. of cobalt. This compared with the former output of 125,000 oz. a month. Directors recently made a statement to the effect that on account of the depletion of the high-grade ore reserves, production would be curtailed.

In June the Vipond Mines, of Porcupine, milled 7,536 tons of ore and recovered $55,100, an average of $7.33 a ton.

At the annual meeting of the Ontario Mining Association held in Temagami, Harry Oakes, of the Lake Shore Mines, was elected president; J. Y. Murdoch, of the Noranda, first vice-president; and Dr. J. Mackintosh Bell, of the Huronian Belt Co., second vice-president. The executive committee consists of J. P. Bickell, of the McIntyre Mines; J. P. Watson, of the Mining Corporation; A. F. Brigham, of the Hollinger Mines; J. Y. Murdoch, of the Noranda; and J. Mackintosh Bell, of the Huronian Belt.

Fire Breaks Out in Quincy Mine, in Michigan Copper District

Fire broke out July 13 in No. 2 shaft of the Quincy mine, at Hancock, in the Michigan copper district. The night shift men at work in the botton levels made their way to surface through No. 6 shaft. Steps were immediately taken to seal the shafts and connecting levels to smother the fire, and it is believed this action will be successful. It is fairly well established that the seat of the fire is in the shaft at the 53 level. No men were at work above the 77 level when the fire was discovered. The shaft is bottomed at the 89 level. The cause of the blaze has not been determined. It was not discovered until a skip rope broke, sending the skip to the bottom of the shaft. For approximately 150 ft. above the fire there is no timber in the shaft.

Johannesburg Letter

By John Watson

Special Correspondent

Mineral Production of Union of South Africa Decreases in April

Johannesburg, June 14—The mineral production for the Union of South Africa for April showed a decrease in value of £206,881, compared with March, but an increase of £480,784 when compared with April of 1926; details follow:

	April	March
Gold	£3,502,584	£3,660,796
Silver	9,968	9,786
Osmiridium	4,744	4,637
Platinum	10,274	33,074
Diamonds	1,129,858	1,141,825
Coal	296,064	308,159
Copper	37,029	37,157
Tin	24,013	36,198
Other minerals	42,324	32,107
Total value	£5,056,858	£5,263,739

Among the "other minerals" in April asbestos was first, with a total value of £31,221.

The following results of crushings, for May, from seventeen leading Rand gold mines, have recently been published; the mines are arranged in order of profits earned:

	Tons Crushed	Value or Revenue £	Costs per Ton s	d	Estimated Profit £
Government Areas	200,000	388,965	16—	1.3	230,300
New Modder	133,000	310,961	19—	7.5	180,453
Crown Mines	222,000	310,223	19—	11.5	88,692
Modder Deep	44,200	99,640	15—	6.0	65,364
Springs	65,200	125,432	20—	8.9	57,814
Brakpan	78,500	137,397	20—	9.7	55,730
New State Areas	71,000	130,663	21—	8.7	54,219
Modder B	68,500	112,459	18—	0.2	50,736
Van Ryn Deep	68,000	108,272	17—	3.9	50,275
Geduld	84,000	117,078	16—	7.0	47,382
Sub Nigel	19,000	.....	40—	4.4	42,649
Randfontein	212,000	214,918	17—	7.9	30,719
West Springs	49,000	77,181	19—	1.6	30,308
Langlaagte Estate	80,000	101,159	20—	2.4	21,015
Consolidated Main Reef	59,100	90,233	24—	11.4	16,508
Robinson Deep	77,500	.....	18—	10.0	13,343
Modder East	59,000	75,718	21—	9.7	11,380

The latest find of alluvial diamonds has been on the Trans-Kei side of the Kei River, where John Bock, of Kingwilliamstown, has purchased ten acres of ground at the mouth of the Kei and has found about eighty diamonds in the last fortnight. The largest stone, so far, found by Mr. Bock is of about five carats. The diamonds are being found on sand, and no washing is required—only sieving. The stones vary in color from water-white to amber, amethyst, pale emerald, and pure black.

On the Johannesburg Stock Exchange during the last week the volume of business has been small. London has in the main, been selling, but bought East Geduld shares, which have improved from 38s. 6d. to 40s. Waaikraals have improved from 26s. to 38s. 6d. Potgietersrust platinums have fallen from 6s. 10½d. to 6s. 7d. per 5s. share. Central Platinums were higher, between 3s. and 4s. 3d., with large dealings.

During the preceding week the turnover was considerable. London was a big buyer of platinum shares here, at improving prices. Some say this indicates the formation of a platinum syndicate to control the output.

Societies, Addresses, and Reports

World Economic Recovery Task of International Chamber

Other Important Questions Discussed by Experts from Forty-one Nations

By Edward J. Mehren
Vice-President, McGraw-Hill Publishing Co., Inc.

Stockholm, July 2, 1927.

AS ALREADY REPORTED in cables, the problem of removing the trade barriers which hamper international trade, particularly in Europe, was the dominant topic of the fourth congress of the International Chamber of Commerce, which closed here today. The enthusiasm with which the various delegations, from forty-one countries, supported the recommendations and thus approved the conclusions of the International Economic Conference at Geneva is virtually a pledge that they will go home with the intention of impressing on their ministries the need of legislative steps to remove the barriers; and to remove them because such removal will be to the best interest of their own respective countries. Thus the Chamber and its national committees become the driving force behind the Geneva recommendations. The congress also discussed a dozen reports on various phases of international trade, the reports being the result of long work by committees of experts representing many countries.

Alberto Pirelli, of Milan, Italy, was elected president of the Chamber for the next two years, and Amsterdam selected for the next meeting in 1929.

TRADE BARRIERS

So much attention has been given the subject of trade barriers in *Engineering and Mining Journal* in reports from Geneva and in cable messages from Stockholm that repetition is not called for here. It should be noted, however, that the conclusions are not aimed particularly at the United States tariff wall, and that other barriers besides tariffs are considered. In fact, the chief difficulty for Europe are the European trade barriers, including 11,000 km. of tariff walls erected since the war. To clear up the meaning of the term barrier, the committee, at Owen D. Young's suggestion, happily prefaced its report with a definition and preamble, as follows:

"Trade barriers in the international sense are those arbitrary national restraints on the free movement of goods, capital, and services which not only restrain trade and traders but limit the economical production and distribution of goods, capital, and services to the detriment of the peoples affected by the restraint. They depress the standards of living.

"In production of all kinds there is a unit of maximum economy. In distribution there is a market of maximum economy. Any barrier which prevents the co-ordination of the two is a trade barrier in the large sense in which this congress uses the term. Trade is not an end in itself. It is only a means to an end. The general economic welfare is its goal."

PLEA FOR ACTION

The conclusions on trade barriers, practically identical with those of Geneva, favor (1) the cessation of tariff increases and the beginning of a movement in the opposite direction; (2) equal treatment of foreigners and foreign corporations engaged in trade or industry; (3) removal of obstacles to transportation; (4) elimination of prohibitions on exports and imports; (5) simplification of customs classifications; (6) unification of tariff nomenclature; (7) stabilization of customs tariffs; (8) simplification of customs formalities; (9) removal or decrease of those tariff barriers that gravely hamper trade, starting with those which were imposed to counteract the effects of disturbances arising out of the war; (10) long-term commercial treaties; (11) removal of all barriers to free movement of capital.

Owen D. Young, chairman of the Board, General Electric Co., and chairman of the American delegation

Finally, the congress indorsed the conclusions on rationalization and international industrial pools (or ententes) reached at Geneva, and already published in the July 9, 1927, issue of *Engineering and Mining Journal.*

The Chamber then called upon its national committees to urge upon their governments the adoption and application of the Geneva and Stockholm conclusions, to make these representations before the end of September, 1927, and report the result of their action to the Chamber, so that a summary of the progress achieved might then be published. In other words, an active campaign to secure the practical application of the Geneva conclusions was put under way.

The meeting on trade barriers was ably presided over by Norman H. Davis, one of the official American delegates to the International Economic Conference, and Dr. Karl Kotzenburg (Germany.)

SALTER'S GREAT ADDRESS

Sir Arthur Salter, head of the Economic Section of the League of Nations, under whose auspices the Geneva meeting was held, made a stirring address on the relative functions of the League and the Chamber in getting action on the Geneva resolutions. The League has an official entrée to governments which the Chamber does not possess. The Chamber, on the other hand, has a freedom of action not open to officials, and this freedom gives the Chamber a driving power which can be used for bringing the League's work to success. Sir Arthur declared that the League Secretariat welcomed pressure from the Chamber and hoped that the Chamber would always assume the initiative, as it had done in the trade barriers matter. Based on these general declarations he appealed for action on the Geneva resolutions, and particularly for pressure by the Chamber's national committees on the governments at home.

Following Sir Arthur, Sir Alan Anderson, retiring president, added his voice in a plea for prompt and vigorous action. He said that there are in Europe 5,000,000 out of work, and 20,000,000 more under-employed, who, stood side by side, would make a line 11,000 miles long, the distance from England to Australia. It was a queue of wretchedness, of sickly children, of suffering mothers. How soon would the delegates and the national committees take action and get results at home? He begged them to keep their eyes on that 11,000-mile queue of wretchedness and press on quickly, aggressively, to bring it relief.

ADDITIONAL SUBJECTS

On the matter of uniform regulations on bills of exchange and checks the Chamber indorsed the action of its committee in preparing a draft of rules for the unification of the Latin and Germanic systems. The aim is to have only two systems: That of the United States and Great Britain, and the other what may be called the "Continental." The draft does not affect the American and British—or Anglo-Saxon—system. The Chamber also indorsed the calling of an international conference on the subject, to function as a continuation of the similar Hague conference of 1910 and 1912.

The Committee on Export Commercial Credits (commercial letters of credit) brought in a provisional draft for standardization of practice (on which eight countries, including the United States, have uniform regulations). The work received general approval and the committee was directed to continue its work until a final draft is developed.

Double taxation, as in previous congresses of the Chamber, came in for vigorous handling, the aim being to secure the abandonment of double taxation of nationals resident abroad. The League of Nations is also working on the problem. Certain amendments were suggested to the League's draft convention on the subject, notably to secure unconditional adherence to the basic principle that "impersonal taxes should be levied at the source by the country of origin and that personal taxes should be levied by the country of domicile."

A uniform method of presenting national balances of payment is being developed by the Committee on International Settlements as a needed step in studying the great question of transfers, not only in connection with reparations but with international debt payments and all other international settlements affecting world trade. The work of the committee, which will be of great importance in following the effects of these huge settlements upon exchange, was approved, and the committee continued under the title, Committee on International Settlements and Economic Information.

Patents and Judgments

Important recommendations made by the Committee on Protection of Industrial Property (concerned chiefly with patents and trade marks), are (1) that the sanction for the non-working of a patent, in countries where such rules are in force, be no longer forfeiture of the patent, but merely the grant of a compulsory license; (2) that registry of grantees, owners, and licensees of patents be established in all countries and that documents or instruments not registered shall not be valid against third parties; (3) that all countries adopt a system of protection for inventions shown at fairs and exhibitions; (4) that national committees should urge their respective governments to ratify the decisions of the Hague conference on patents without restriction or reserve.

Various amendments of the rules for commercial arbitration and conciliation were approved.

Certain suggestions to guide jurists in the drawing up of rules for enforcement of foreign awards (exequatur) were approved and referred to legal international bodies.

A committee on fairs and exhibitions is to be created "to conciliate the interests at stake, avoiding at the same time any undue multiplicity of such undertakings liable to throw an ever-increasing burden on those participating therein."

Transport and Communication

On transport there were a series of reports and resolutions relating to rail and air transport, and to telephony, largely under European conditions. For sea transport the general use of the rules laid down in the Brussels convention of 1922 and 1923 was strongly urged by the appropriate committee and received the indorsement of the Chamber.

In the work and session of the Highway Transport Committee, members of the American delegation took an active part. The Highway Committee of the American Section had offered an elaborate paper on highway transport, dealing with the principles of highway finance, administration, and control in the United States and discussing the relation of highways to other forms of transport. At the highway session, Roy D. Chapin, chairman of the board of the Hudson Motor Car Co., presided and John N. Willys, president of the Willys-Overland Co., read an excellent paper on the development of highway finance practice in the United States. Following the meeting, Mr. Chapin entertained the delegates at luncheon, after which a number of films showing highway transport in America were shown. At the closing session, the following resolutions, submitted by the Highway Committee, were adopted:

"Recognizing that motor traffic, which was once a luxury, has now become essential to the efficiency of a progressive country, the congress recommends:

"a. That special taxes levied on the motor vehicle itself and or on the motor fuel should be based on highway use, devoted to highway purposes, collected and expended under centralized state control.

"b. That highways should be developed to suit modern traffic and that the cost should be distributed in relation to the benefits derived.

"c. That taxes should be such that they will not check the economic use of the motor vehicle.

"d. That where it is necessary to authorize constructors of a special road to charge toll for its use, the state should retain the right on payment of compensation to purchase or control the road.

"e. That city planning should provide for a free flow of traffic and proper facilities for garaging vehicles.

"f. That every precautionary measure should be taken for greater safety on streets and highways, including education of drivers, of pedestrians, and particularly of children."

Representation

Eight-hundred and fifty-two delegates were present from forty-one countries, forming in all an exceptionally able group. The American delegation, with 162 accredited delegates, was second largest in number and in quality compared well with other groups. Germany sent the largest delegation, about 180, the explanation of the large attendance being the proximity of Germany, her close business connections with Sweden, and the intensity of her interest in the work of the Chamber. The Germans came into the Chamber since the Brussels meeting of 1925, so that this was their first meeting.

A feature of the meeting was the assistance proffered at private sessions of the American delegation by the various foreign services of the United State Government. The Minister to Sweden, Mr. Harrison, explained the duties of the diplomatic representatives of the government with reference to commerce: "To keep the highways of commerce open," as he summarized it. The American Consul at Stockholm explained the duties of his office, while the Department of Commerce, under the leadership of the Director of the Bureau of Foreign and Domestic Commerce himself, Dr. Julius Klein, had present the following commercial attachés: William L. Cooper, London; Fayette W. Allport, Berlin; Chester Lloyd Jones, Paris; H. C. MacLean, Rome; Mowatt Mitchell, Brussels; Harry Sorensen, Copenhagen; Ronald H. Allen (acting), Warsaw; Frederick Lyon, Helsingfors; T. O. Klath, Stockholm; and Carl J. Mayer, Riga. These gentlemen, well informed on the countries where they are posted, were available during the congress for consultation by the American business men present.

Entertainment

As is customary at such international gatherings, the entertainment was copious and lavish. The King, the Crown Prince, the Crown Princess, and Prince William attended the opening session, and the King subsequently received the delegates and their ladies in the castle. The Swedish National Committee of the Chamber gave, first, a reception and later a gala banquet,

Concert Hall, Stockholm, where opening meeting of Chamber was held

while the City of Stockholm gave a reception in the Stadshuset (town hall).

NEW PRESIDENT

Alberto Pirelli, the new president, is head of a large corporation, the Pirelli Co., of Milan, Italy, which makes a great variety of rubber goods, including automobile tires, and is a large manufacturer of rubber insulated electric cable. Its interests include rubber plantations in the Far East and factories in Italy, Great Britain, Spain, and the Argentine. His business interests have made him a student of international trade and finance.

Signor Pirelli was a member of the Italian delegations at the Cannes and Genoa conferences, a member of the Dawes Committee, and accompanied Signor Volpi, the Italian Minister of Finance, to America in connection with the settlement of Italy's war debt to the United States. In May he was a member of the Italian delegation to the International Economic Conference at Geneva. He sits on the Economic Council of the League of Nations, not as a government official but in his private capacity as a leading manufacturer. He is chairman of the Italian National Committee of the International Chamber of Commerce, member of the former Committee on Economic Restoration, and chairman of the Committee on International Settlements.

AMONG THOSE PRESENT

Among the American delegates present were: Owen D. Young, chairman of the board, General Electric Co., and chairman of the American delegation; Albert F. Bemis, Bemis Bros. Bag Co., Boston; Willis H. Booth, vice-president, Guaranty Trust Co., New York; William Butterworth, president, Deere & Co., Moline, Ill.; William M. Chadbourne, New York, representing the American Zinc Institute; L. K. Comstock, L. K. Comstock & Co., New York; Colonel Hugh L. Cooper, New York; Joseph H. Defrees, former president, Chamber of Commerce of U. S. A., Chicago; John A. Edgerton, president, National Association of Manufacturers; John H. Fahey, Boston; Edward A. Filene and A. Lincoln Filene, Boston; W. W. Freeman, vice-president, Columbia Gas & Electric Co., Cincinnati; Philip H. Gadsden, vice-president, United Gas Improvement Co., Philadelphia; Carl E. Grunsky, San Francisco; Clarence Howard, president, Commonwealth Steel Co., Granite City, Ill.; Fred I. Kent, vice-president, Bankers Trust Co., New York; Charles H. MacDowell, president, Armour Fertilizer Works, Chicago; William C. Redfield, former U. S. Secretary of Commerce, Brooklyn; Alfred Reeves, general manager, National Automobile Chamber of Commerce, New York; E. W. Ryberg, Salt Lake City, delegate from the Associated General Contractors of America; Silas H. Strawn, chairman of board, Montgomery, Ward & Co., Chicago; Edward A. Sumner, American Radiator Co., Paris; F. W. Walker, president, Associated Tile Manufacturers, Beaver Falls, Pa.; F. D. Waterman, president, L. E. Waterman & Co., New York; and Windsor White, chairman of board, White Motor Co., Cleveland.

How to Get Practical Results From World Economic Conference

Extracts From Address of Sir Arthur Salter, Head of Economic Section, League of Nations, Before Stockholm Congress, International Chamber of Commerce, on July 1, 1927

OUR TASK (in connection with the world's economic recovery) and in particular the task of this International Chamber of Commerce and of the forces and institutions which it represents, is at its beginning and not its end. The first stage was that of securing unanimous agreement from the conference of Geneva on sufficiently drastic, far-reaching, and effective resolutions. This first stage has been accomplished with a success which has exceeded the most sanguine hopes of those who initiated the conference. The second stage, and perhaps the more difficult, is that of securing the adoption, and application in practice to commercial policies, of the resolutions.

Alberto Pirelli, rubber manufacturer, Milan, Italy, new president of International Chamber of Commerce

The nature of the task which lies ahead of us is perhaps most clearly shown by recalling the main substance of what the conference advised. I will confine myself to the most vital of the resolutions on Commerce. The central theme of the conference was that trade barriers, and in particular tariffs, are *too high, too complex,* and *too frequently changed.* The recommendation on which it places most emphasis is that *they should be reduced,* should be *simplified and unified,* and should be made *more stable.* Let us glance in turn at each of these problems.

HEIGHT OF BARRIERS

As to the height, the conference starts with four declarations: that the present high tariffs have a harmful effect on trade and production; that substantial improvement in economic conditions can be obtained by increased facilities for trade and commerce; that tariffs, though within the sovereign jurisdiction of the different states, are not a matter of purely domestic interest; and lastly that some of the causes which have resulted in increased tariffs (such as currency fluctuations) have now largely disappeared, while others are diminishing. In these conditions, the conference categorically declares that "the time has come to put an end to the increase in tariffs and to move in the opposite direction." It suggests four lines of action: (1) Independent action by the several states to remove or diminish tariff barriers; (2) concerted action through commercial treaties; (3) the abolition of the practice of imposing bargaining tariffs (*tariffs de combat*) in advance of negotiations; and (4) an examination by the Economic Organization of the League, in consultation with such organizations as this Chamber, and with the governments, as to the best methods of securing further action to the same end.

As to simplification and unification, the conference asks the League to establish the appropriate procedure, while suggesting the following principles: That there should be a systematic customs nomenclature under a plan covering all classes of goods, but that a priority should be established among the various group of commodities, a beginning being made with those classes for which a common nomenclature can be most readily introduced; that not only governments but the producing and commercial organizations should be asked to co-operate at every stage; that the common nomenclature, as worked out from time to time, should be made effective by bilateral for plurilateral conventions; that further simplification and merging of groups within the standard system of subdivision should be contemplated; and that in order to insure the execution of engagements the League should propose measures of publicity, information, and friendly settlement or arbitration. As to the third desideratum, stability in tariffs, the conference declared that "A decisive step on the road to world reconstruction would undoubtedly be taken if the system of long term treaties securing equality of treatment were restored." And in this connection I may remark that whereas, before the war, commercial agreements normally had a duration of ten or twelve years, no less than 153 out of 180 post-war agreements recently examined were terminable within the year.

This then is the unanimous advice of what is perhaps the most authoritative body of experts that has ever met to discuss economic policies. I come to the two crucial questions. What are the chances that this advice will be adopted and applied in practice? How is this result to be secured?

WILL ADVICE BE APPLIED?

The difficulties are only too obvious. At every vital point the decisions of

governments are required—decisions to change policies on which they have embarked, administrative systems, and methods which they are working. All the trade barriers which the conference wishes to remove are buttressed both by fallacies and by vested interests; and some by what is, on a short view, a real national advantage. The obstacles to reform are greater than those which retarded the application of the financial recommendations of Brussels; and the direct motive power is in some respects weaker and less concentrated. The financial recommendations of 1920 required separate action by each state, in what was obviously its own direct interest. The economic recommendations of 1927 require in large part concerted or at least general action, in the interest of a general prosperity in which each country will enjoy a share, but a share not directly proportionate to its own action.

Happily there are powerful considerations on the other side. In the first place, the conference brought out with great force and clearness the fact that the worst abuses which it condemned had arisen through causes which have now disappeared or are diminishing. As the causes are disappearing, it is at least easier to remove their effects. Stronger as a ground for hope perhaps is the fact that the conference revealed an already existing feeling, of much greater force and wider range than had been suspected, that the process of increasing barriers had gone too far and must be reversed. The conference could hardly have improvised or initiated such a movement; but by developing it, expressing it, and adding the consciousness of collective support, it has given it an immense increase in strength. Third, we have the great collective influence of the members of the conference and of all those institutions, like the Chamber, who have collaborated with it. One hundred ninety-four members, attended by one hundred fifty-seven experts, appointed by governments and representing every kind of qualification and every shade of responsible opinion, have spoken unanimously and categorically, and it is difficult to believe that their advice can be disregarded. Certainly the members themselves—and no men could be better judges of the difficulties—speak in terms which suggest not only hope but confidence. They look forward to the "beginning of a new era"; they anticipate that "international commerce will successfully overcome all obstacles in its path that unduly hamper it."

Direction of Efforts

I come now to the last and most important question of all: How must effort be directed, to secure the desired result? There is no simple answer. But one thing is clear. International organizations—the Chamber and the League—may do much. But the greater part of the work is likely to be and must be national. Members of the Chamber may do a great deal in international conference and committee; but they can do even more in mobilizing the forces in their own countries and modifying the policies of their own governments.

Probably the most urgent and important thing at present is that governments should definitely adopt the recommendations of the conference, and declare their intention to make their policies conform to them. We have already had a splendid lead. Within a few days of the conference the Belgian Government declared that it gave its full adhesion to the resolutions, and was prepared at once to come to an understanding with other countries on the lines laid down by the conference. M. Vandervelde followed this up by stating to the council of the League that for an exporting country like Belgium the adoption of the recommendations was a matter of life and death, and that for such a country political independence was conditional upon a recognition of economic interdependence. M. Benes followed with a formal declaration that the Czechoslovakian Government also adhered to the resolutions and intended to develop its policy in conformity with the principles which they embodied. Herr Stresemann then declared that the German Government gave as full and unqualified an approval as the Belgian Government, and had just taken a formal decision concurring in the conclusions and declaring itself ready to co-operate energetically in giving effect to them. I am circulating to all members a full report of the very remarkable declarations made both by these and other countries at the council of the League. Nothing could be so useful for our future work as a series of formal decisions and declarations, similar to those which I have quoted, from other countries. They would give a momentum to the movement which would be irresistible. They would determine the character, and accelerate the progress, in all the more technical and detailed work which must follow.

In securing such results I suggest that those here present can play a part of the utmost importance. It means mobilizing every kind of appropriate force in each country; working through the press, through meetings, and by every method which can move public opinion and governmental action. I venture to suggest that this is more than an opportunity—that it is also a duty. M. Theunis, in his concluding speech, reminded the members of the conference that in voting for the resolutions they had each undertaken a personal, moral obligation "to do all in their power to disseminate, to defend, and to secure the triumph of the tasks they had formally proclaimed." Herr Stresemann, in addressing the council as rapporteur a fortnight ago, said he was sure that the members of the council, which had convened the conference, would feel an equally strong moral engagement. May I suggest that the members of this International Chamber, whose advice has had such a determining influence on the conference's resolutions, have a similar moral responsibility—individual as well as collective, and acting severally in the respective countries as well as in international meetings—to do all in their power to secure that they are applied in practice.

I have purposely put in the forefront the need for action in each country in informing and arousing public opinion, in evoking and maintaining public interest, and in influencing the policy of governments, because I think it is at once the most urgent, the most difficult, and the most important part of the task that lies ahead. Detailed execution will go as far as, and no further than, national policies allow it: International action can gather the harvest, as it sowed the seed, but it can only help here and there in the intermediate work.

At the same time there is much that can, and must, be done by international organizations. The Economic Committee of the League is meeting in a few days' time to consider a plan for the tariff questions and to study in particular how to organize the work on customs nomenclature; and in September the council has announced its intention of considering changes in the constitution of the League's Economic organization. If, however, you will not consider it an impertinence, I should like now to suggest, in the barest outline, what this Chamber and its members can do.

First—Whether as individuals or as organizations the members, each in his own country, in conjunction with the members of the Economic Conference, with the national chambers of com-

Parliament Building, Stockholm, where all sessions, except the session opening the congress, were held

merce and with the national committees and all other persons and institutions that can be used for the purpose in the same country, can arouse and maintain public opinion; can secure that the recommendations of the Economic Conference are proclaimed and debated in public meetings and in parliament; can assist their governments to adopt the policy of the conference and to make declarations similar to those made by Belgium, Germany, and Czechoslovakia; and can secure that actual commercial and economic policy is modified accordingly.

Second—The Chamber, here in Stockholm and through its central council, can appoint special standing committees for each of the main tasks, including, for example, one on customs nomenclature and one on general tariff and commercial policy questions. It would be the task of these committees to organize efforts and work both internationally through appropriate subcommittees, through special experts, through trade committees, and through the national committees of the Chamber, and in close contact with the League.

Third—At this conference at Stockholm members of the same or closely associated trades and industries of different countries might meet and begin discussions as to the best methods by which trade barriers can be removed or reduced in the sphere with which they are specially concerned. So far as such discussions contemplate anything in the nature of international industrial agreement, they would doubtless be guided by the principles laid down in the report of the Economic Conference. I suggest discussions between closely associated industries, including, for example, a primary industry and the industry which uses its products as its own raw materials, and between similar industries of different countries, because such discussions are favorable to a genuine attempt to remove trade barriers in the particular economic sphere which they cover.

Fourth—The national committees of the Chamber, which did much valuable work in preparing the resolutions of the Economic Conference, might meet with the definite purpose of organizing the efforts within each country to secure their adoption. In this case I suggest the committees should meet as a whole, including all trades and industries, and should divide their work rather by subject than by industry; for group meetings of a particular industry within a single country are not the most favorable means of securing tariff reductions. The work of such national committees, and of their subcommittees, would doubtless be encouraged and to some extent guided by the international committees of the Chamber which I have suggested above.

Fifth—The International Chamber will doubtless take all the necessary measures to collaborate with the League both by the methods already in operation and any others that may seem desirable. I cannot of course anticipate the decision of the council of next September as to changes in the League's present organization, but I may, I think, say at least this without indiscretion: I cannot conceive any plan of reorganization which does not include within it not only provision for the continuance of the present collaboration, but facilities for even closer, more intimate, and more extensive association between the two institutions which are both so vitally interested in the common task left by the Economic Conference.

Results Vital to World

This, then, in the barest outline, is the nature of our task and the way in which we may accomplish it. Let me in conclusion recall its vital importance not only to all the interests here represented but to the world as a whole.

We have in the resolutions of the Economic Conference the unanimous advice of the most authoritative body of world experts that has ever met as to the direction in which the economic policies of the world ought to develop.

We have their considered opinion that the adoption of what they recommend will substantially increase the prosperity of the world.

We have their equally authoritative and unanimous opinion that not only the increased prosperity but the maintenance of the peace of the world depends largely upon economic policies being transformed as they desire; for the evils they wish to remove cause not only loss but friction; they are obstacles not only to the growth of trade but to international good will.

Surely, if the unanimous advice of a conference so appointed and so qualified is disregarded, we shall begin to despair, not only of one conference, but of international conferences in general; despair indeed of reason itself, or at least of collective reason, as the guide to the government of the world.

In this tremendous, and still doubtful, issue may I express my conviction that this International Chamber, its members acting individually and collectively, the great institutions which they represent, and the powerful forces which they influence can play an immense and perhaps a decisive part. With your wholehearted aid, but scarcely I think without, we may hope for the realization of what the members of the conference declared to be their unanimous desire that we shall now see the "beginning of a new era, during which international commerce will successively overcome all obstacles in its path that unduly hamper it, and resume that general upward movement, which is at once a sign of the world's economic health and the necessary condition for the development of civilization."

American Silver Producers to Be Represented at Salt Lake

Federal and state taxation of mines, improvement in the silver market, stabilization of the mining industry, and workmen's accident compensation will be considered in the sessions of the American Mining Congress, at the joint convention of the Western division of the congress, the Western regional section of the American Institute of Mining and Metallurgical Engineers, and the governors of the American Silver Producers' Association at Salt Lake City, during the week beginning Aug. 22. Several hundred delegates are expected to attend from all parts of the country, as many questions affecting the mining industry generally will be considered during the week.

In view of the present investigation of the federal tax system by the joint Congressional committee on internal revenue taxation and the prospective revision of tax rates and revenue law, administrative provisions at the forthcoming session of Congress, the conventions of these mining organizations will devote considerable attention to the tax question. The Salt Lake City meeting will bring together for the first time in a number of years the complete membership of the general tax committee of the American Mining Congress for the purpose of formulating definite recommendations to the Federal Congress for tax revision. Heretofore meetings of the general tax committee have been held by a smaller group constituting its executive committee. The tax committee will report to the convention the results of its studies of tax revision as a basis for action by the convention on tax reform. Those sessions of the convention devoted to consideration of taxation will center largely on the mine depletion section of the revenue act, although all other phases of mining taxation will be considered.

The price of silver, which has been at a low level for the last few years, and the foreign silver situation in relation to its effect on the American silver-producing industry, will be taken up by the convention. Steps calculated to encourage the increased use of silver in world coinage and in the arts will also be considered. The government's relation to the silver industry will come up for discussion when the directors of the American Silver Producers' Association consider the latest developments in its attempt to have the Treasury Department purchase 15,000,000 oz. of silver at $1 per ounce to complete purchases under the Pittman Act of 1918. The association recently entered suit in the District of Columbia Supreme Court to compel the government to make this purchase, legislation for this purpose having failed in the last two sessions of Congress, although the bill was passed both times by the Senate, only to be killed in the House. The Oriental silver situation, particularly in India and China, will come up for attention, as these countries purchase considerable quantities of American silver.

Officers and directors of the organizations will be elected at the forthcoming convention, which will be featured by a mining exposition by the U. S. Bureau of Mines and the metallurgical research department of the University of Utah. Imer Pett and A. G. Mackenzie, of Salt Lake City, are in charge of the arrangements for the sessions of the American Mining Congress, which will be held Aug 22, and G. H. Clevenger for the meetings of the Institute on Aug. 23 and 24. D. A. Lyon, superintendent of the Salt Lake experiment station of the Bureau of Mines, is assisting in arranging the exhibit and the program for the Institute sessions.

Personal Notes

Reno Sales, chief geologist for the Anaconda Copper Mining Co., visited Salt Lake recently on business.

Charles A. Mitke has been making a professional visit to the United Verde Extension Mining Co. at Jerome, Ariz.

W. C. Ringsleben, geologist for the Hollinger Consolidated, is examining properties in the eastern section of the Patricia district.

Prof. Leslie Ransome, of the Institute of Technology at Pasadena, Calif., is making a geological survey of the United Verde Extension mine.

E. Godfrey Lawford

E. Godfrey Lawford, who has recently joined the staff of *E. & M. J.*, began his career with the Kyshtim Corporation in Russia in 1910. He entered the Royal School of Mines, London, in 1913, but at the end of the first year the war broke out and he joined the Royal Engineers, going overseas in 1915. From 1915 to 1918 he saw service on all parts of the British front in France and Belgium. After the war Lawford returned to the Royal School of Mines, graduating in 1921. From 1921 to 1927 he held various positions with the Santa Gertrudis Co., Pachuca, Mexico, having been for the last two years a division foreman on the company's Dos Carlos mine.

Dr. A. L. Hall, assistant director of the South African Geological Survey, has left Pretoria on a visit to the platinum fields around Potgietersrust.

Walter Douglas, president of the Phelps Dodge Corporation, recently visited the corporation's properties in New Mexico, Arizona, and Sonora.

Oscar H. Hershey, consulting geologist with headquarters in San Francisco, is at Tybo, Nev., on professional work for the Treadwell-Yukon Co.

H. A. Johnson, superintendent at the Tonopah Mining Co.'s plant at Tonopah, Nev., has returned to Tonopah from a short trip to Los Angeles.

C. B. Dawson, geologist, is in charge of work for the Huronian Belt Co. on its holdings in the Clearwater Lake area of the Patricia district of Ontario.

Thomas M. Kekich, metallurgist, who was connected with the General Development Co., Campo Morado, Guerrero, Mexico, has arrived in Alton, Ill.

W. Dyke Poynter, mining commissioner at Pilgrims' Rest, in the Transvaal, with Mrs. Poynter, is on a month's leave and is touring the country by motor car.

Lieutenant Colonel J. P. Grenfell, chairman of the Messina (Transvaal) Development Co., Ltd., sailed from Southampton recently on his periodical visit to the mine.

Charles W. Newton, general manager of the Callahan Zinc-Lead Co., of Wallace, Idaho, has returned to Wallace from a business trip in the Michigan copper district and New York City.

J. O. Elton, manager of the International Smelting Co., and **Tom Lyon,** geologist for the company, recently inspected Rico operations, where the company is operating a 250-ton flotation mill.

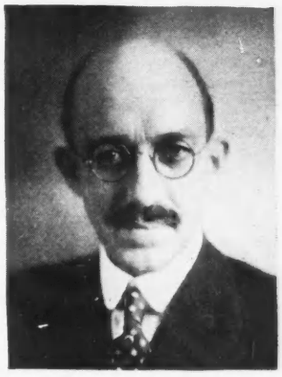
Charles Hurter, technical representative, in the mining field, of the E. I. du Pont de Nemours Co., is spending six months in Colombia, South America, on professional business for his company.

W. C. Page, superintendent of concentration for the International Smelting Co., has resigned his position to join the staff of a British company developing a copper concession in the Rhodesian Congo.

Scott Turner, director of the U. S. Bureau of Mines, has returned to his desk in Washington after a visit to the Western stations and field offices of the Bureau. He visited the helium-gas fields and each of the sites where the Bureau has drilled or will drill for potash.

Richard Hamilton, late general manager of the Great Boulder mine, and president of the West Australian Chamber of Mines since its formation, has been elected president of that body for a further term. Mr. Hamilton is now on the way to Great Britain to enjoy a holiday after many years of strenuous service.

Elmer Allen Holbrook, dean of the School of Mines and Metallurgy of Pennsylvania State College, has been appointed dean of the Schools of Engineering and Mines at the University of Pittsburgh, to succeed **Dr. Frederick L. Bishop.** Dr. Bishop, on retiring from the office of dean, plans to devote his time to research and teaching. He will continue as professor of physics at Pitt, and as consulting engineer to several large Pittsburgh firms. The new dean will take office Sept. 1. Dean Holbrook has been at Pennsylvania State College since 1922. He was graduated from Massachusetts Institute of Technology in 1904 and received the honorary degree of engineer of mines from the University of Illinois in 1916. After several years of practical work as superintendent of mining companies in Montana, in Mexico, and in Canada, he designed and erected a mining and metallurgical laboratory for the province of Nova Scotia and became professor of these branches at the Nova Scotia Technical College. From 1914 until the outbreak of the war, Dean Holbrook was professor of engineering at the University of Illinois. He then entered the service of the U. S. Bureau of Mines and was appointed acting chief mining engineer of the Bureau at Washington, D. C., in 1918. He was sent to Pittsburgh as first superintendent of the new station and research laboratories of the Bureau in 1919, and became assistant director of the Bureau at Washington in 1920, a position which he held until his appointment as dean of the School of Mines and Metallurgy at Pennsylvania State College in 1922. Dr. Bishop, the retiring dean, received his doctor's degree from the University of Chicago and is a consulting physicist. He is editor of *Engineering Education* and author of numerous articles on thermal conductivity, electric furnaces, viscosity, mechanical manufacture of glass, and related subjects.



Elmer Allen Holbrook

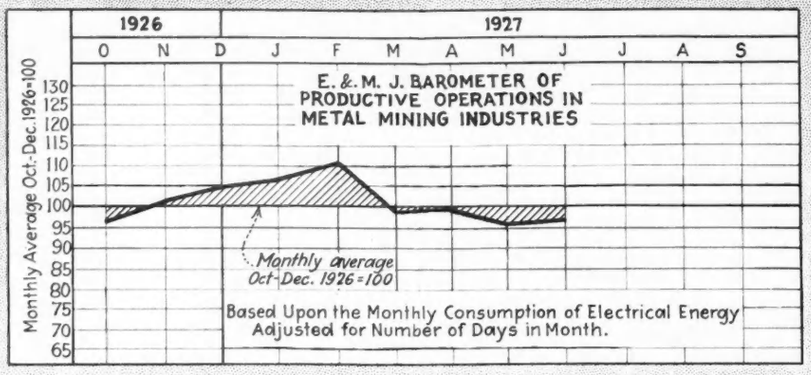
Obituary

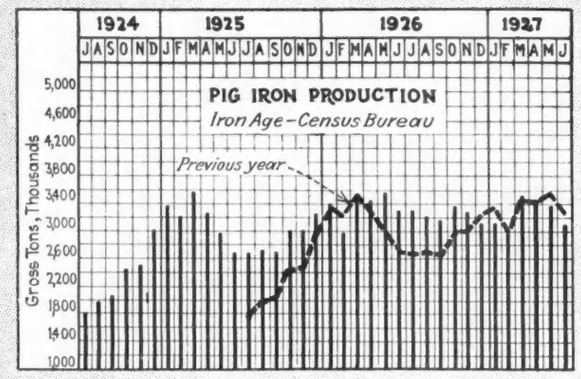
George Kislingbury, consulting mining engineer, died recently in Los Angeles at the age of seventy-nine. He came to this country from England in 1857, and following the Civil War was engaged for a time in lead and zinc mining in Wisconsin, later going to Colorado. He was the author of the first mine inspection bill, adopted by the State Legislature of Colorado in 1889, and held the office of State Mine Inspector for a number of years.

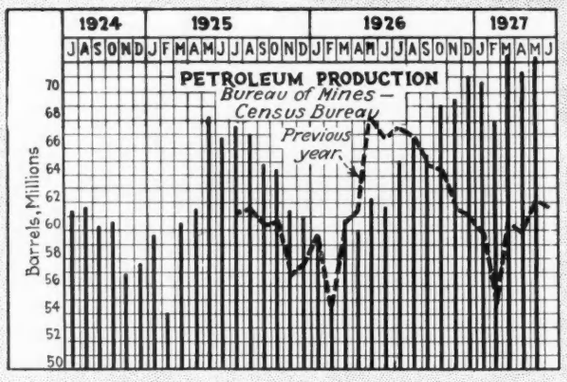
Carl Bernard Ferlin, president and manager of the Yankee Mining Co., operating in the American Fork district, near Salt Lake, died on July 3. Mr. Ferlin, who was highly regarded by Utah mining men, both for his engineering and operating ability, had suffered for several years from arthritis. Born at Stettin, Germany, March 15, 1878, he was educated as a mining engineer at the University of Stockholm. As a young man, Mr. Ferlin went to Utah, where at Bingham and Park City he engaged in mining. Surviving Mr. Ferlin are his widow, Catherine Franklin Ferlin, and relatives in Sweden.

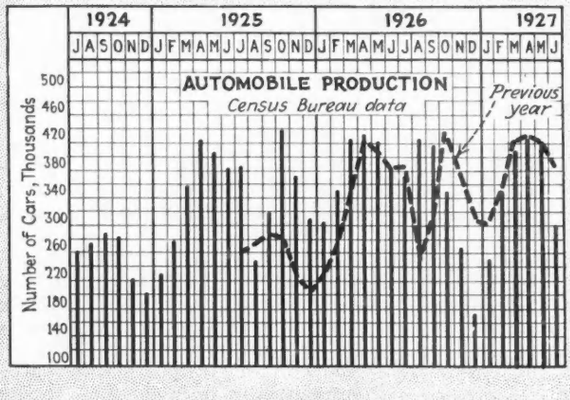
Indicators of Industrial Activity

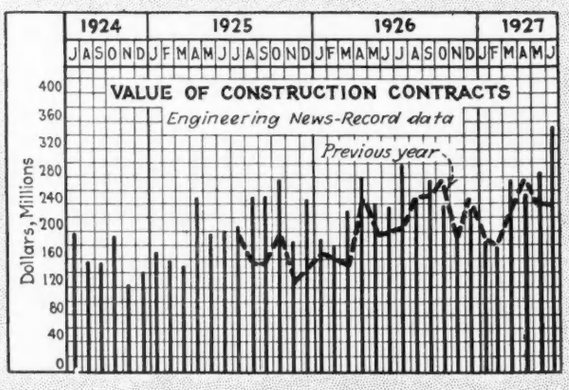
of Significance to Mining

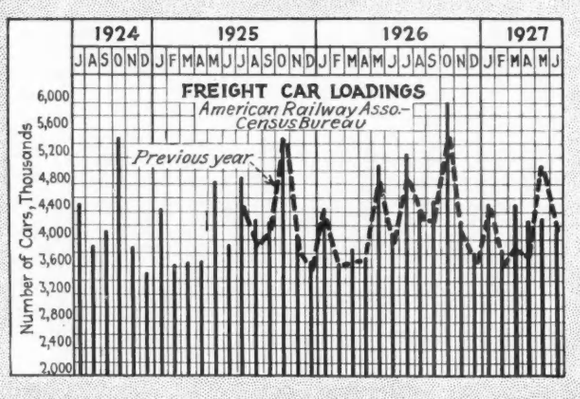

1926
1927
O N D J F M A M J J A S
E. & M. J. BAROMETER OF PRODUCTIVE OPERATIONS IN METAL MINING INDUSTRIES
Monthly Average Oct.-Dec. 1926=100
130 125 120 115 110 105 100 95 90 85 80 75 70 65
Monthly average Oct.-Dec. 1926=100
Based Upon the Monthly Consumption of Electrical Energy Adjusted for Number of Days in Month.

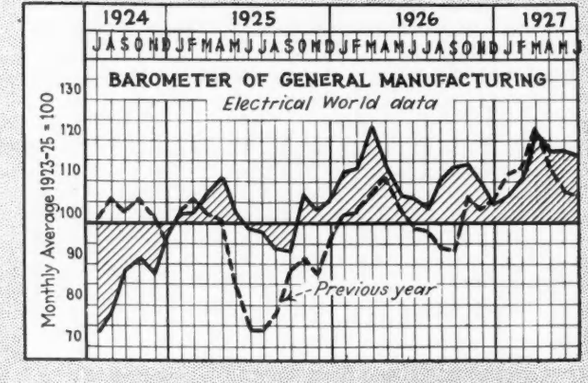

1924 1925 1926 1927
J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J
PIG IRON PRODUCTION
Iron Age—Census Bureau
Previous year
Gross Tons, Thousands
5,000 4,600 4,200 3,800 3,400 3,000 2,600 2,200 1,800 1,400 1,000


1924 1925 1926 1927
J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J
PETROLEUM PRODUCTION
Bureau of Mines—Census Bureau
Previous year
Barrels, Millions
70 68 66 64 62 60 58 56 54 52 50


1924 1925 1926 1927
J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J
AUTOMOBILE PRODUCTION
Census Bureau data
Previous year
Number of Cars, Thousands
500 460 420 380 340 300 260 220 180 140 100


1924 1925 1926 1927
J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J
VALUE OF CONSTRUCTION CONTRACTS
Engineering News-Record data
Previous year
Dollars, Millions
400 360 320 280 240 200 160 120 80 40 0


1924 1925 1926 1927
J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J
FREIGHT CAR LOADINGS
American Railway Asso.—Census Bureau
Previous year
Number of Cars, Thousands
6,000 5,600 5,200 4,800 4,400 4,000 3,600 3,200 2,800 2,400 2,000


1924 1925 1926 1927
J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J
BAROMETER OF GENERAL MANUFACTURING
Electrical World data
Previous year
Monthly Average 1923-25 = 100
130 120 110 100 90 80 70

Market and Financial News

A European View of the Platinum Situation

Increased Consumption Anticipated as a Consequence of Lower Prices—Soviet Plans to Dominate Market

By A. M. Linde
Director of the Edelmetalls-Vertriebs A. G., Berlin

The recent entry of the Russian Soviet into the American platinum market as sellers through special agents direct to consumers has demoralized the situation here and forced the price to less than $65 per ounce. The following article is published as reflecting a responsible European view of the subject, although the Engineering and Mining Journal is not prepared to give unqualified endorsement to some of the conclusions drawn.

IT IS QUITE understandable that the technical and economic press of late has given special attention to the platinum market in view of the sharp drop in the prices for the metal during the last few months. The platinum market has a record for wide price fluctuations. If we consider the movement of the prices paid for this metal, say for the years 1900 to 1926, we can find again and again periods during which quotations were constantly going up. On the other hand, we also find rather violent slumps, after which the pendulum swung back.

During the years noted both production and consumption as well as prices have systematically advanced. How is the lack of stability in the prices accounted for? The explanation is found in the fact that the market hitherto was monopolized by a few large platinum concerns, which built up their business on the principle of getting a maximum of profit out of their special position, regardless of the production cost of the metal. This monopoly of the platinum market existed until lately. Recently a complete revolution has taken place, however; and the slump now apparent signifies a fundamental reorganization of the entire platinum market.

It is generally known that Russia was, prior to the World War, the principal and almost exclusive source of supply for platinum in the markets of the world. Russia's share in the world output was about 93 per cent, for example, from 1910 to 1912. If to these data the figures of the unlawful exportation of platinum from Russia, which are not covered by any statistics, are added, the above-mentioned figures undoubtedly are increased.

The marketing of platinum up to the beginning of the World War and even after its termination was until last year in the hands of large French, American, and English firms, which were associated with one another by agreements after the fashion of a syndicate. With such a condition the prices for platinum, of course, could never be regarded as the effect of a balancing between consumption and production. An arbitrary restriction of production permitted the maintenance of excessively high prices, whereby normal extension of consumption was rendered impossible.

Soviet Russia, which possesses abundant deposits of platinum, will endeavor to sell the output at prices which are determined exclusively by the cost. For that reason the prices demanded by Russia will be substantially lower than those prevailing in the last few years, which surely will exercise a great influence on the extension of the consumption.

The time of excessively high platinum prices is a thing of the past; and the present level must be considered as that at which the prices will be more or less constant for some time to come. Just as the selling prices of all goods must have a certain relation to their manufacturing price, the price of platinum can derive its justification only from the cost of production of the Russian platinum.

Other sources of platinum production (Colombia and the Transvaal), where the cost of production is substantially higher, will have to curtail mining as early as this year, in all probability, and it must be expected that Russian platinum will recover in the course of the next few years the position in the world market which it occupied until the World War.

It is entirely wrong to assume that the Russian platinum industry, possibly on account of the elimination of competition and owing to the increased demand, will develop or proceed in the manner described at the beginning of this article and try to exploit its monopolistic position for the purpose of obtaining excessive profits.

In harmony with its interests in the platinum market, Soviet Russia will systematically carry out development and exploration of new platinum deposits and thus bring about an expansion of its production. That the Soviet platinum industry is even now seriously engaged in this task is clearly shown by the following:

Since the beginning of this year a complete reorganization of the platinum business is being carried out in the interior. By replacing small obsolete steam dredging machines by modern and powerful electric dredges, a substantial saving is effected in the cost of production. The advantages of this equipment are not only reduction in the cost of production; in spite of the important drop in prices as compared with last year, it pays to mine deposits leaner in platinum. The electrically operated dredges with a capacity of 11½ and 13½ cu.ft. accomplish a yearly output of from 35,000,000 to 40,000,000 cu.ft. Under these circumstances the mining of ground which contains only 0.0016 oz. of platinum per ton is worth while. The deposits being exploited at present, on the other hand, contain on the average of 0.0045 oz. per ton. Installation of big electric dredges with a high capacity on the one hand, and the development of new platinum deposits in the primary rock on the other, show that exhaustion of the platinum deposits of the Urals, which a few foreign writers profess to believe impends, is still extremely remote. Prof.

World's Copper Stocks Decline

IN CONSIDERING the world's stock of copper "above ground," inclusion should be made of supplies in foreign countries as well as in North and South America. The following table represents the total supply in producers' possession:

World's Visible Supply of Copper in Producers' Hands

In Tons

North and South America	1924 Jan. 1	1925 Jan. 1	1926 Jan. 1	1927 Jan. 1	1927 July 1
Blister at smelters	17,836	9,306	10,461	15,849	15,103
Blister in transit	58,500	70,966	61,141	68,604	60,946
Blister at refineries	41,279	26,640	30,851	30,514	26,910
In process at refineries	135,765	130,616	146,422	158,168	154,673
Refined	155,885	136,434	73,082	85,501	96,360
Total	409,265	373,962	321,957	358,636	353,983
Foreign					
Great Britain	34,734	43,029	62,773	38,792	24,676
Harve	2,091	8,042	3,375	9,688	(a) 6,000
Japan	4,767	11,042	5,543	5,099	(a) 5,000
Grand total	**450,857**	**436,075**	**393,648**	**412,215**	**389,650**

(a) Estimated.

N. Visotzki figures the extent of the platinum deposits which contain an average content of not less than 0.003 oz. per ton at about 1,500,000 oz. A survey made by Prof. M. Lipovsky in conjunction with the installation of new and more efficient dredges, of the platinum deposits so far known, resulted in estimates of about 7,000,000 oz. as a possibility. These figures presumably speak for themselves.

Backed by such advantages, the policy followed by Soviet Russia of expanding the consumption by virtue of more reasonable prices and thus creating a market for increased production, is in all probability a wise one.

The opinion of many specialists that with the present prices, which are substantially lower than those charged in former years, dentists will go back to the more general use of platinum, seems well founded. The chemical industry, too, will extend its requirements of platinum materially beyond the pre-war figures, and, finally, "white gold" will presumably be crowded out of the market.

A platinum industry built up on the principles described will surely eliminate any element of speculation and lay the corner-stone for a systematic and sound development of the market. By the same token, prices based on the cost of production, instead of on artificial control, will contribute not a little to the growth of the consumption of so unique and useful a metal.

Sharpe Attributes Depression in European Zinc Market to Speculative Operations

IF MAY was a black month in the European zinc industry, then the smelters may have better cause to remember June on account of the fears prevalent toward the end of the month as to a price crisis in sympathy with the heavy slump in the selling price of pig lead, according to A J. M. Sharpe, honorary foreign correspondent of the American Zinc Institute. Slab zinc has never been able to cut itself adrift from lead and steer an independent course on the market. A reference to price graphs reveals that the movement in the selling price of pig lead is more or less faithfully followed by the market quotation for zinc.

During June the lowest price touched was £28 2s. 6d., contrasting with a quotation in May of £27 17s. 6d., and in mid-June the price on the London Metal Exchange had actually climbed to over £29 per long ton. Lead then began to fall as a result of heavy liquidation, until today (July 5) the quotation for July shipment is no better than £22 17s. 6d., or £1 15s. 0d. a ton lower than the price current on June 23. The zinc market sagged in sympathy, and with the turn of the month the downward movement became accelerated by the jettisoning of stocks held by speculative holders. Thus at the moment of writing the London Metal Exchange is quoting £27 10s. 0d. for July shipment and £27 7s. 6d. for October.

Statistically, continues Mr. Sharpe, there is no reason for slab zinc selling today at £1 11s. 3d. per ton cheaper than on June 14. European stocks of metal did not increase by more than 1,300 tons during June. The jettisoning of stocks mentioned in the preceding paragraph must not be confused with sales of actual metal. On the London Metal Exchange transactions are mainly of a "paper" nature, so that the turnover does not represent the sale of an equivalent quantity of metal. Mr. Sharpe illustrates his point by quoting the position of speculators who in April bought three months' shipment for a rise. The sellers have the right to give notice of delivery to these buyers on any day during July, so that naturally if actual metal arrives by steamer due to berth within a few days after such notice is given, these speculators (who at no time had any intention of buying and taking up metal) must re-sell and pass on the delivery notice to buyers who are willing to accept delivery of the tonnage of slab zinc in question. When this re-selling occurs on an unwilling market it is not difficult to understand why on some days the quotation for zinc is particularly weak.

In Mr. Sharpe's opinion if we analyze what ought to be the dominating laws for regulating the price of zinc—viz, supply and demand—we find that so far as Europe is concerned consumption is almost identical with production plus imports of High Grade from North America and from Australia. At the present selling price, there are comparatively few European smelters which are making much profit; quite a number are on the border line between profit and loss, and some by continuing operations are actually involved in a loss.

Mr. Sharpe estimates world stocks of zinc on July 1, 1927, as follows:

	Metric Tons
United States	39,871
Canada	2,600
Australia (including afloat)	2,800
Germany-Poland	6,800
Belgium	3,300
France	1,300
Great Britain	1,500
Scandinavia	200
Far East	500
Elsewhere	1,500
Total	60,371

Mr. Sharpe feels that it is certain that if the market remains at or below the current level for any length of time, both the smelters and ore producers must take stock of the situation and revise their policies. Already the returning charge has been advanced by Continental smelters up to the point where it is impracticable for some mines to produce ore at a profit, so that the supply must steadily diminish for economic reasons unless there be a recovery in the selling price of metal, the average monthly price for which is the basis on which ore is bought and sold. The ore seller delivers at recognized ports such as Antwerp and Hamburg, and the competition to buy is reflected in the range of the aforesaid returning charge.

No ores other than Australian are likely to be imported by Great Britain for the next few years except during periods of high market prices for slab zinc. The British production of metal in June is computed at 4,450 long tons.

Harriman Russian Manganese Concessions Revised

Important changes in its concessions to operate Russian manganese deposits have been negotiated by W. A. Harriman & Co. Concerning the nature of the concessions W. A. Harriman said recently:

"We signed a concession agreement in June, 1925, and control of the production of the mines was taken over on July 25, 1925. Soon after we found that competition from Nikopol, situated in one of the republics belonging to the Soviet Union, was operating against the success of our business, as well as certain unforeseen conditions.

"We took up with the Soviet Government the question of revising the contract to make it workable and of mutual benefit.

"I am now in position to state that our differences with the Soviet Government have been cleared up, and the revised contract was signed in Moscow by my associate, R. H. M. Robinson, and the Concession Committee of the Soviet Government has ratified it."

The revised contract provides for three basic changes, it is understood. They are: First, royalties to be paid by the Georgian Manganese Co. are changed to a sliding scale, based on market price, present royalty being $3 a ton. Second, the company is relieved from requirement to construct a broad-gage railroad in place of the present narrow-gage line. The Harriman contention that the expense was not warranted was agreed to by the Soviet officials. Third, an arrangement was made as to the quantity of exports of manganese from Nikopol, in the Ukraine field. Surplus from this field has been competing with the Harriman shipments from the Georgian mines, in the Caucasus, and taking away their markets.

Statistical Notes

South African Platinum is as yet relatively unimportant, as is shown clearly by recent output figures. The total monthly production of South Africa is only about 1,250 to 1,500 oz., whereas the Russian and Colombian outputs together average some 13,000 oz. per month.

The Tonopah Canadian Mines has made arrangements to resume operations on the Morrison property, in Gowganda. The new deal involves the formation of a $3,000,000 company to be called the Morrison Mines, Ltd. The Tonopah company will put up sufficient funds to continue operations for eighteen months and will receive a substantial block of stock and an option on sufficient more stock to get control.

The Market Report

Copper, Lead, Zinc, Tin, and Silver Prices Higher in Active Markets

New York, July 20, 1927—It is something of a novelty to be able to report improvement in all of the major nonferrous metal markets at the same time. This can be done today. The last week has been unusually active in copper, zinc, and lead; consumers have bought tin in good volume; China and India both have bought silver; and without exception prices for each of these metals are higher than a week ago. Antimony, quicksilver, and platinum continue dull, with little change in price.

Copper Seems Strong at 12⅞c.

Copper has continued its upward course, begun three weeks ago, with a further increase in the volume of business, which was the best for seven weeks. Last Thursday little metal remained available at concessions from 12⅝c. in the East and a good tonnage was sold in the Middle West at 12¾c. Friday was particularly active at 12¾c., delivered in the East, and on Saturday the bulk of a good business was done at 12¾c. in the East. This continued on Monday, and on Tuesday nothing was available under 12¾c. and sales were made at 12¾c., some of the metal being for Connecticut delivery. Today's prices have ranged from 12.80 to 12¾c., with the higher level apparently well established this afternoon. The attitude of sellers is very different from that displayed on former occasions this year when the market has started upwards. They seem confident that buyers are in need of metal for early requirements, and in this view they are supported by the fact that the great bulk of the recent business has been for August delivery. Some sellers have declined to take business for October at current levels. Although the June statistics fail to reveal any consequential decline in the rate of world production, the leading producers seem confident that curtailment still will prove to be more than a gesture. One factor in the strength of the domestic market is the unusually active buying abroad, done during the last week at the fixed price of 13c. c.i.f. Germany is the outstanding customer, but France and Great Britain have participated. Standard copper has advanced sharply in London.

Lead Up to 6.30c., New York

Today the American Smelting & Refining Co. advanced its contract price for New York lead from 6.20 to 6.30c., following a week of excellent business in the lead market and an advance of almost a pound sterling in the London quotations. This is perhaps the best news that has developed for lead producers since the last advance by the Smelting company, which was made on March 3 and which brought the price of lead up to 7.65c. Since then, the course of the market has been downward. Early in June there was a period of heavy buying, but the Smelting company's price was not advanced, for, as was plainly evident a few days later, the strength was only a flash in the pan. It is encouraging to find that the Smelting company considers the present market sufficiently sound to warrant a price advance, as these changes are wont to start or continue a long-term trend.

Practically all producers who have been free sellers have had an unusually active week, especially those producing in the Middle West. Deliveries for July and August will draw on surplus stocks accumulated at higher prices, so sellers are not anxious to book very much more than current production at present levels. Most of the demand has been for prompt shipment, though August has also been in large demand. Some inquiries have been made for September, but producers are not anxious to sell so far forward and in some instances have quoted small premiums. With the advance in London, Mexican ore lead will continue to go abroad, though some people believe the early fall demand will be sufficient to absorb a portion of it on this side. Recent production figures indicate that United States and Mexican output is at approximately as high a rate as ever and show no cause for any fear of a lead scarcity. There was a reduction of about 5,000 tons in the stocks of refined lead at the end of June, but when the

Daily Prices of Metals

July	Copper	Tin		Lead		Zinc
	Electrolytic, N. Y.	99 Per Cent	Straits	N. Y.	St. L.	St. L.
14	12.40@12.425	62.25	63.875	6.20	5.95	6.15@6.175
15	12.40@12.425	63.00	64.50	6.20	5.95@6.00	6.175
16	12.40@12.525	63.00	64.50	6.20	5.975@6.00	6.175@6.20
18	12.40@12.525	63.00	64.00	6.20	5.975@6.00	6.175@6.20
19	12.525@12.55	62.25	63.75	6.20@6.225	6.00	6.20
20	12.60@12.65	62.25	64.00	6.30	6.10	6.25
	12.485	62.625	64.104	6.219	6.000	6.194

Average prices for calendar week ending July 16, 1927, are: Copper, 12.404; 99 per cent tin, 62.083; Straits, 63.917; N. Y. lead, 6.204; St. L. lead, 5.965; zinc, 6.175; and silver, 56.188.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis; i.e., delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted, and prices at so-called Middle West destinations, 0.325c. above.

Quotations for copper are for ordinary forms of wire bars, ingot bars, and cakes. For ingots an extra 0.05c. per pound is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

July	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
14	53 7/8	54 7/16	60	286 3/8	280 1/8	22 13/16	23 5/16	27 7/8	27 5/8
15	54 5/16	54 13/16	60	290 1/4	282 1/8	23 1/8	23 9/16	28 3/16	27 15/16
18	54 9/16	54 7/8	60	291 1/4	282	23 5/16	23 11/16	28	27 3/4
19	54 7/8	55 3/16	60	285 3/4	279 5/8	23 5/16	23 11/16	28 1/4	27 7/8
20	55 1/2	55 13/16	60	286	280 1/8	23 11/16	24 3/16	28 9/16	28 3/16

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

July	Sterling Exchange "Checks"	Silver		Gold London	July	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
14	4.85 1/8	56 1/8	25 7/8	84s11 1/4d	18	4 85 1/8	56 1/2	26	84s11 1/4d
15	4.85 1/8	56 1/4	25 7/8	84s11 1/4d	19	4 85 1/8	56 3/4	26 3/16	84s10 3/4d
16	4 85 1/4	56 1/4	25 15/16	.....	20	4 85 1/8	56 3/4	26 1/4	84s11d
					Avg.		56.438		

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-half cent premium.

figures for lead in ore, matte, and base bullion are issued, it is believed that this decrease will be fully offset.

Zinc at 6.25c.

The London zinc market, as in the case of copper and lead, has stiffened during the week, and buying in the domestic market has been active, with prices advancing from day to day. Part of the buying was of a speculative character, but galvanizers and brass manufacturers also bought. Quotations for High-Grade zinc for prompt delivery in New York continue nominally at 8c. per lb.

Tin Close to 64c.

The tin market has been active, as has the market for the other metals. Prices, however, show little change, having ruled around 64c. for prompt Straits most of the week. Much of the buying has been by consumers. Forward deliveries are offered at discounts of about one-quarter cent per month in the future.

Silver Higher and Steady

The silver market has been much more active during the last week, with good demand for India and China account. Prices rose sharply on Tuesday because of large orders from India, but requirements from this quarter were satisfied, and the market is now only steady at about ¼c. below the high in New York.

Mexican Dollars — (Old Mexican pesos): July 14th, 42¼c.; 15th and 16th, 42⅝c.; 18th, 42¼c.; 19th and 20th, 43c.

Foreign Exchanges Steady

Changes in the principal foreign exchanges have been slight. On Tuesday, July 19, closing cable quotations were as follows: francs, 3.915c.; lire, 5.44c.; and marks, 23.785c. Canadian dollars, 5/32 per cent discount.

Other Metals

Quotations cover large wholesale lots unless otherwise specified. London prices are according to latest mail advices.

Aluminum—Per lb., 98 or 99 per cent grade, price of leading interest, 26c.; outside market, 25.30@25.80c.

Antimony—Per lb., duty paid, New York: Chinese brands, range for the week, spot business, 11⅛@11⅜c. September arrival about ⅛c. higher. Cookson's "C" grade, spot, 17¾c. Market dull and prices largely nominal. Needle antimony nominally 8c. for lump and 10c. for powdered. White oxide, 16½c.

Bismuth—Per lb., New York, in ton lots, $1.85@$2.10. London, 8s.

Cadmium—Per lb., New York, 60c.

Iridium—Per oz., $107@$110 for 98 @99 per cent sponge and powder.

Nickel — Per lb., ingot, 35c.; shot, 36c.; electrolytic, 39c. (99.75 per cent grade) for single lots of spot metal.

Palladium—Per oz., $52@$54. Small lots bring up to $58. Pure metal as a constituent of crude platinum, nominal.

Platinum—Official price quoted by the leading interest on small miscellaneous orders for refined metal, per oz., $72. Open market cash sales of large lots, in New York, $62.50@$64.50. Largely nominal. Pure metal as a constituent of crude platinum, nominal at $61. Very dull. London, per oz., £13½ @£13¾.

Quicksilver—Range for week, $120@ $121, nominal, per 76-lb. flask. Market shows more life. San Francisco wires $120.67. London, £20¾@£22.

The prices of Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Monel Metal, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tellurium, Thallium, Tungsten, and Zirconium are unchanged from the issue of July 9.

Zinc Blende and Lead Ore Prices Unchanged

Joplin, Mo., July 16, 1927

Zinc Blende

	Per Ton
High	$44.25
Premium blende, basis 60 per cent zinc	$43.00@44.00
Prime Western, basis 60 per cent zinc	$42.00@43.00
Fines and slimes, 60 per cent zinc	39.00@41.00
Average settling price, all zinc	40.32

Galena

High	$79.70
Basis 80 per cent lead	75.00
Average settling price, all lead	77.81

Shipments for the week: Blende, 11,838; galena, 2,459 tons. Value of shipments for the week, $668,700.

Some buyers filled short orders on a $42 basis, but the larger quantity of blende was purchased on a basis of $43, with $44 being paid for a fractional tonnage of premium ore. The total tonnage purchased was 10,500 tons.

Smelter mine-owners shipped lead ore heavily from mines to smelters; there were two or three sales of increased tonnage, but otherwise the market was quiet.

Platteville, July 16, 1927

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$44.75
Lead Ore	
Lead, basis 80 per cent lead	$78.00

Shipments for the week: Blende, 1,190 tons; lead, 80 tons. Shipment for the year: Blende, 36,161; lead, 970 tons. Shipments for the week to separating plants, 2,296 tons blende.

Metallic Ores

Manganese Ore—Per long ton unit of Mn, c.i.f. North Atlantic ports, minimum 47 per cent Mn, 36@38c., Caucasian, washed, 53@55 per cent, 40c. Chemical grades unchanged from quotations in the July 9 issue.

Tungsten Ore — Per unit of WO_3, N. Y.; Wolframite, $10.25@$10.50. Western scheelite, $10.75@$11. Market dull and prices largely nominal.

Chrome, Iron, Molybdenum, Tantalum, Titanium, Uranium, and Vanadium Ores are unchanged from quotations in the July 9 issue.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz, Rock Crystal, Silica, Spodumene, Sulphur, Talc, Tripoli, and Zircon are unchanged from prices in the July 9 issue.

Mineral Products

Arsenious Oxide (White Arsenic)— 3¾c.@4c. per lb. Active buying with advancing price levels. London, Cornish white, per long ton, £15½.

Calcium Molybdate, Copper Sulphate, Sodium Sulphate (Salt Cake), Sodium Nitrate and Zinc Oxide are unchanged from prices in the July 9 issue.

Ferro-Alloys

Ferrochrome—Per lb. of contained chromium, 60@70 per cent chromium, 4@6 per cent carbon, 11½c.

Ferromanganese—Domestic and foreign, 78@82 per cent, $90 per long ton, furnace or duty paid. Consumers well covered for early needs. Spiegeleisen, 19@21 per cent, $33@$34 f.o.b. furnace.

Ferrotungsten—96@98c. per lb. of W contained, f.o.b. works. Dull.

Ferrocerium, Ferrophosphorus, Ferrosilicon, Ferrotitanium, Ferro-uranium and Ferrovanadium are unchanged from prices in the July 9 issue.

Metal Products

Rolled Copper—Sheets, 21½c.; wire, 14½@14¾c. f.o.b. mill.

Lead Sheets—Full rolled, 9¾c. per lb.; clipped, 10c.

Nickel Silver—28½c. per lb. for 18 per cent nickel Grade A sheets.

Yellow (Muntz) Metal—Dimension sheets, 18¾c. per lb.; rods, 15¾c.

Zinc Sheets—9¾c. per lb., f.o.b. mill.

Refractories

Chrome Brick, Fireclay Brick, Magnesite Brick, Silica Brick and Zirkite are unchanged from quotations in the July 9 issue.

Iron and Steel Steady But Dull

Pittsburgh, July 19, 1927

Business in iron and steel is quite steady; and, though dull, is not as dull as was expected from the sharp decrease in activity in the early part of June. There has been little further drop since then. At the same time the indications of recovery in the Autumn, that have frequently been seen by this date, are not apparent.

Finished-steel prices are holding well, no declines having been recorded for some time. In sheets, strips, and wire products price advances of four months ago in strips and just recently in wire are not yet fully tested, as there are still deliveries on old engagements.

Pig Iron—The market continues dull. Prices are holding in the Valleys, at $18.50 for bessemer, $17.50 for basic, and $18 for foundry. Southern iron has dropped 75c. to $17.25, Birmingham, the last decline having been six months ago.

Connellsville Coke — The market is barely steady, with demand light. Spot furnace, $3; spot foundry, $4@$4.75.

Mining Stocks—Week Ended July 16, 1927

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	45¼	43¼	44⅞	Jy.16, Au.22 Q	0.75
Arcadian Consol.	Boston	*35	*25	*25		
Ariz. Com'l	Boston	6¼	5	5¾	Jy. 18, Jy. 30	0.25
Calaveras	N. Y. Curb			1¾		
Calumet & Arizona	New York	65¾	64¾	65¾	Ju. 13, Ju. 20 Q	1.50
Calumet & Hecla	Boston	15	14½	15	My.31, Jn.15 Q	0.50
Cerro de Pasco	New York	60⅜	58⅜	59½	Jy.14, Au.1 Q	1.00
Chile Copper	New York	35⅜	33½	34⅜	Jn.3, Jn.30, Q	0.62½
Con. Coppermines	N. Y. Curb	2½	2¼	2½		
Copper Range	Boston	13¼	12	13	Ap.2, My.2, A	1.00
Crystal Copper	BostonCurb	*48	*45	*48		
East Butte	Boston	1½	1½	1½	Dec., 1919	0.50
Granby Consol	New York	38⅞	35⅞	38⅛	Jn.15 Jy. 1 Q	1.00
Greene-Cananea	New York	50⅛	42	49⅜	Nov., 1920	0.50
Howe Sound	New York	37¼	34⅜	37¼	Apr.1, Apr.15 Q	1.00
Inspiration Consol	New York	17⅞	13½	17⅛	Ma.17, Ap.4, Q	0.25
Iron Cap	Boston Curb	1⅜	1⅜	1⅜		
Isle Royale	Boston	10⅜	9	10	Fe.4, Fe.19, Q	0.50
Kennecott	New York	64	60⅜	63⅜	Ju. 3, Jy. 1 Q	1.25
Magma Copper	New York	35½	33½	34⅜	Jn.30, Jy.15, Q	0.75
Mason Valley	N. Y. Curb	1	*94	*94		
Miami Copper	New York	14⅛	13⅜	14⅛	Au.1, Au.15 Q	0.37½
Mohawk	Boston	40½	38⅜	40	Jy.30, Se.1 Q	1.00
Mother Lode Coal	New York	2¼	2⅛	2⅛	Jn.10, Jn.30	0.25
Nevada Consol	New York	14⅛	13⅛	14⅛	Jn. 3, Jn. 7 Q	0.37½
New Cornelia	Boston	19⅞	19⅜	19¾	My.6, My.23 Q	0.50
Noranda	N. Y. Curb	23⅛	22¾	23		
North Butte	Boston	*99	*85	*99	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	*95	*80	*94	Sept. 1926	0.03
Old Dominion	Boston	12¼	11⅛	12¼	Dec., 1918	1.00
Phelps Dodge	N. Y. Curb	110	110	110	Jn.18, Jy.1 Q	1.50
Quincy	Boston	15½	13½	14½	March, 1920	1.00
Ray Consolidated	New York	14⅞	14¾	14¾	Ap.20, Ap. 30	0.25
St. Mary's Min. Ld.	Boston	20⅛	19	20⅛	Fe.10, Ma.10	2.00
Seneca Copper	New York	1¼	1¼	1¼		
Shattuck-Denn	Boston Curb	4¾	4	4		
Tenn. C. & C.	New York	8⅛	8⅛	8⅛	My.31, Ju.15, Q	0.12½
United Verde Ex.	N. Y. Curb	24⅛	23½	24	Jy.6, Au.1 Q	0.75
Utah Copper	New York	115	115	115	Jn. 17, Jn. 30 Q	1.50
Utah Metal & T.	Boston	*96	*85	*96	Dec., 1917	0.30
Walker Mining	Salt Lake	*55	*51	*55		
NICKEL-COPPER						
Internat. Nickel	New York	63⅜	60⅛	61⅛	Jn. 16, Jn. 30 Q	0.50
Internat. Nickel pfd.	New York	...	...	109	Ap. 14, My. 2 Q	1.50
LEAD						
Gladstone Mtn	Spokane	*15	*11½	*11½	April, 1927	0.005
National Lead	New York	107⅜	101	107½	Jn. 10, Jn.30 Q	1.25
National Lead pfd.	New York	108½	107⅜	108⅛	My.10, Jn.15 Q	1.75
St. Joseph Lead	New York	37⅛	37⅛	37⅜	Se.10, Se.20, QX	0.75
ZINC						
Am. Z. L. & S.	New York	7½	7	7	May, 1917	1.00
Am. Z. L. & S. pfd.	New York	40⅛	38	38	Nov., 1920	1.50
Butte C. & Z.	New York	4⅜	4⅛	4⅛	De. 9, De. 24	0.50
Butte & Superior	New York	8⅛	8⅛	8⅛	Jn. 17, Jn. 30 Q	0.50
Callahan Zn-Ld	New York	1⅜	1⅛	1⅛	Dec., 1920	0.50
Consol. Lead&Zinc'A'	St. Louis	12⅛	12	12	Ma.15, Ap.1 Q	0.25
Eagle-Picher	Cincinnati	27	26¼	27	Au.15, Se.1 Q	0.40
Eagle-Picher pfd.	Cincinnati	...	...	116	Jn.30, Jy.15 Q	1.50
New Jersey Zn	N. Y. Curb	184	183	183	Jn.20, Jy.9 QX	2.00
United Zinc	N. Y. Curb	...	...	*55		
Yellow Pine	Los Angeles	*25	*20	*25	Dec. 1925 Q	0.04
GOLD						
Alaska Juneau	New York	1¼	1¼	1¼		
Argonaut	Toronto	*31	*27½	*29½		
Barry-Hollinger	Toronto	*34	*27	*32½		
Consol W. Dome L.	Toronto	*7	*5	*6		
Cresson Consol. G.	N. Y. Curb	2⅛	2 1/16	2 3/16	Ma.31, Ap.10 Q	0.10
Dome Mines	New York	7⅞	7⅛	7⅛	Jn. 30, Jy. 20 Q	0.25
Golden Cycle	Colo.Springs	†1.70½	†1.67½	...	My.31, Jn.10 Q	0.04
Hollinger Consol	Toronto	18.60	18.10	18.25	Jn. 29, Jy. 15 Q	0.10
Homestake Mining	New York	61½	61	61½	Jy. 20, Jy. 25 M	0.50
Kirkland Lake	Toronto	1.41	1.36	1.40		
Lake Shore	Toronto	20.25	19.51	20.15	Jn.1, Jn.1 X	0.20
McIntyre-Porcupine	New York	...	...	26	Au.1, Se.1 Q	0.25
Portland	Colo.Springs	†*36	†*25	...	Ap.6, Ap.15, Q	0.02
Rand Mines	New York	...	...	9½	Au.23-30 Am.Sh.	1.52
Teck-Hughes	Toronto	8.57	8.15	8.30	Jy.21, Au.1	0.10
Tom Reed	Los Angeles	*48½	*45	*45	Dec., 1926	0.02
Tough-Oakes	Toronto	*31	*27	*27½		
United Eastern	N. Y. Curb	*44	*44	*44	July, 1924	0.05
Vipond Cons	Toronto	*76¾	*75	*76¾	Apr.1, Apr.15	0.03
Wright-Hargreaves	Toronto	5.99	5.55	5.80	Jy.15, Au.1	0.05
GOLD AND SILVER						
Carnegie Metals	Pittsburgh	*12	*12	*12		
Con. Cortez	N. Y. Curb	*19	*19	*19		
Con. Virginia	San Francisco	*3½	*3½	*3½		
Dolores Esperanza	N. Y. Curb	...	...	*50	July, 1923	0.05
Premier Gold	N. Y. Curb	2⅛	2 1/16	2 1/16	Jn. 14, Jy. 5	0.08
Tonopah Belmont	N. Y. Curb	...	...	1⅜	Ma.15, Ap.4	0.08
Tonopah Extension	N. Y. Curb	*55	*35	*51	Apr. 1925	0.05
Tonopah Mining	N. Y. Curb	...	...	2 1/16	Ma.31, Apr.21	0.07½
West End Consol	N. Y. Curb	...	...	*7	Mar., 1923	0.05
Yukon Gold	N. Y. Curb	...	...	*45	June, 1918	0.02
SILVER						
Beaver Consol	Toronto	1.09	1.02	1.06	May, 1920	0.03
Castle-Trethewey	Toronto	*80	*77	*77½		
Coniagas	Toronto	3.95	3.70	3.70	May, 1924	0.12½
Keeley	Toronto	1.08	1.00	1.00	Fe.28, Ma.15 X	0.12
Lorrain Trout Lake	Toronto	...	...	*73	July, 1925	0.05
McKinley-Dar.-Sav.	Toronto	*15½	*14½	*15	Oct., 1920	0.03
Mining Corp. Can.	Toronto	3.20	3.05	3.05	Jn. 29, Jy.15	0.12½
Nipissing	N. Y. Curb	5⅞	5½	5½	Jn.30, Jy.20	0.07½

Stock	Exch.	High	Low	Last		Last Div
SILVER-LEAD						
Ahumada	New York	3¼	3	3⅛	Ma. 25, Ap.4, QX	0.12½
Bingham Mines	Boston	44	42	43½	Jn.27, Jy. 5 Q	1.00
BunkerHill&Sullivan	N. Y. Curb	93	91	92½	My.31, Jn.4 X	0.75
Cardiff M. & M.	Salt Lake	*46	*45	*45	Feb. 5, 1927	0.10
Chief Consol.	Salt Lake	2.80	2.75	2.75	Nov., 1926 Q	0.10
Consti'nMng.&Mill'g	Spokane	*30	*25	*25		
Erupcion	Boston Curb	*52	*43	*43	Jn. 25, Jy. 5 Q	0.07½
Eureka Lily	Salt Lake	1.45	1.40	1.45		
Federal M. & S.	New York	1.50	1.37	1.45	Jn.25, Jn.29 Spec.	$10
Federal M. & S pfd.	New York	94½	94	94½	My.25, Ju.15 Q	1.75
Hecla Mining	N. Y. Curb	14⅞	14½	14⅝	My.4, Ju. 15 Q	0.25
Highland-Surprise	Spokane	*13	*12	*12		
Iron King Mining	Salt Lake	*50	*45	*50		
Keystone Mining	Salt Lake	*20	*20	*20	Au. 12, Au. 26	0.07½
Lucky Jim	Spokane	*18¾	*18½	*18½		
Lucky Tiger-Com.	Kansas City	†7.00	†6.75	...	Jy.10, Jy.20	0.05
Mammoth Mining	Salt Lake	...	...	1.80	Jn.10, Jn.20 Q	0.05
Marsh Mines	Spokane	1.00	1.00	1.00		
North Lily	Salt Lake	3.45	3.30	3.45		
Park Utah	New York	6½	6½	6½	Jn. 25, Jy. 1 Q	0.20
Plutus Mining	Salt Lake	...	...	2.05	Jy. 10, Jy. 15 Q	0.10
San Rafael	San Francisco			*24		
Silver King Coal	Salt Lake	7.95	7.85	7.95	Jn. 20, Jy. 1 Q	0.25
Silversmith	Spokane	*30	*30	*30	Oct., 1926 Q	0.02
Stratton Mines	Spokane	*50½	*49	*50½		
Sunshine M. Co.	Spokane	1.04	*90½	1.00		
Tamarack-Custer	Spokane	*26½	*25	*26	Sept., 1924	0.25
Tintic Standard	Salt Lake	12.00	11.75	11.87	Jn.15, Jn.28	0.40
Utah-Apex	Boston	4⅜	4⅛	4¼	Oct., 1926	0.25
IRON						
Bethlehem Steel	New York	51⅞	49½	49⅞	July, 1924	1.25
Cleveland-Cliffs Iron	Cleveland	95	83	85½	Jy. 15, Jy. 25 Q	1.00
Colorado Fuel & Iron	New York	96⅜	92⅛	94½	May, 1921	0.75
Gt. North'n Iron Ore	New York	19¼	18	18⅛	Dec. 6, Dec. 28	0.75
Inland Steel	New York	52⅛	49	50¾	My. 13, Jn. 1 Q	0.62½
Replogle Steel	New York	...	...	12½		
Republic I. & S.	New York	66⅞	63⅜	66¼	My. 14, Jn. 1 Q	1.00
Republic I. & S. pfd.	New York	...	...	103½	Jn. 14, Jy. 1 Q	1.75
Sloss-Sheffield S. & I.	New York	123	123	123	Jn. 10, Ju. 20 Q	1.50
Sloss-Shef. S.&I. pfd.	New York	...	...	107	Jn. 20, Jy. 1 Q	1.75
U. S. Steel	New York	126⅜	1 21⅜	125½	Jn. 7, Jn. 29 Q	1.75
U. S. Steel, pfd.	New York	133¾	133	133½	My.2, My.28 Q	1.75
Virginia I. C. & C.	New York	43	43	43	Jan., 1924	1.50
Virginia I.C.&C. pfd.	New York	....	....	60½	Ju. 15, Jy. 1	2.50
DIAMONDS, PLATINUM, ALUMINUM, VANADIUM, TIN						
De Beers Consol.	New York	27⅜	26½	27⅛	Ja. 26, Ja. 29	1.45
So. Am. G. & P. New.	N. Y. Curb	2⅜	2⅜	2⅜		
Alum. Co. of Amer.	N. Y. Curb	81	79	81		
Alum. Co. of Amer. pf.	N. Y. Curb	102½	102½	1 2½	Jn. 15, Jy. 1 Q	1.50
Vanadium Corp.	New York	49⅜	45½	48	My. 2, My. 16Q	0.75
Patino M. & E.	New York	22⅜	21⅛	22⅜	Ap. 27, My. 5	1 sh.
ASBESTOS						
Asbestos Corp.	Montreal	23½	23	23	Jan., 1926	1.50
Asbestos Corp. pfd.	Montreal	88	87½	87¾	Jn.30, Jy.15	Q-1.75
SULPHUR						
Freeport, Texas	New York	69⅞	68	69	Jy. 15, Au.1 QX	1.25
Texas Gulf	New York	67	63⅞	66½	Ju. 1, Ju. 15 Q	1.00
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	39¼	38	39¼	Au.20, Se.1 Q	0.75
Amer. Metal, pfd.	New York	...	...	108	Au.22, Se.1 Q	1.75
Amer. Sm. & Ref.	New York	161½	152⅝	160½	Jn 8, Au. 1 Q	2.00
Amer. Sm. & Ref. pfd.	New York	126	126	126	Au. 1, Se. 1 Q	1.75
Consol. M. & S.	Montreal	228	223	225	Jn. 30, Jy. 15 X	6.25
Newmont Mining	N. Y. Curb	79	77½	79	Jn.30, Jy.15 Q	1.00
U. S. Sm. R. & M.	New York	36	34½	35⅞	Jy. 6, Jy. 15 Q	0.87½
U.S. Sm. R.&M. pfd.	New York	49	48¼	48⅝	Jy. 6, Jy. 15 Q	0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. F, four weeks. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, J. A. Hogle & Co.; Colorado Springs, Colo., Henry Sachs.

LONDON QUOTATIONS—WEEK ENDED JULY 5, 1927

Name	High	Low	Last	Date	Amount	Last Div.
Aramayo Mines (25 frs.)	80/—	79/4½	80/—	Aug., 1927	5	p.c. (†)
British Platinum (£1)	3/—	1/10½	3/—	Feb., 1925	2½	p.c.
Burma Corpn. (10 rupees)	14/1½	13/6	13/7½	Aug., 1927	6	annas*
Bwana M'Kubwa (5s)	5/9	5/4½	5/6			
Camp Bird (2s)	4/3	3/9	3/9			
El Oro (£1)	4/—	3/9	4/—	Nov., 1924	2½	p.c.*
Esperanza (10s)	—/2½	—/1½	—/2½			
Frontino & Bolivia (£1)	14/3	13/6	13/9	July, 1927	5	p.c.
Mexican Corpn. (£1)	10/9	10/3	10/6			
Mexico Mines of El Oro (£1)	16/3	16/3	16/3	Dec., 1926	3¾	p.c.*
N'Changa C pper Mining	12/9	12/—	12/9			
Oroville Dredging (£1)	5/6	5/3	5/3	Dec., 1923	3¾	p.c.
Ouro Preto (£1)	4/9	4/9	4/9	May, 1925	2½	p.c.
Rhodesian Congo Border (£1)	59/4½	53/9	55/—			
St. John del Rey (£1)	11/9	11/4½	11/9	May, 1927	3¾	p.c.
San Francisco Mines (10s)	29/9	27/3	27/6	July, 1927	15s.	
Santa Gertrudis (£1)	19/3	17/10½	18/3	July, 1927	7½	p.c.
Selukwe (2s. 6d.)	8/4½	7/9	8/—	April, 1917	6¼	p.c.
S. Amer. Copper (2s.)	3/1½	2/9	3/—	Nov., 1917	75	p.c.
Tanganyika (£1)	50/—	47/6	48/1½	Aug., 1926	7½	p.c.
Union Miniere du Haut-Katanga (Brussels)	9.260	9.190	9.190	July, 1927	182.60	(‡)

* Free of British income tax. † Swiss francs and plus 15 p. c. bonus. ‡ Belgian frs. and free of taxation.

New Machinery and Inventions

Portable Standard Meter Is Practically Errorless

A portable meter, to be used as a standard in meter testing, has recently been introduced by the General Electric Co., Schenectady, N. Y. The new meter, designated as Type IB-7, is built for either 110 or 220 volts, 25 or 60 cycles, and 1/5/20 amp. The effects of variation in voltage, frequency and power-factor are said to have been reduced to negligible values. Practically entire freedom from temperature errors is also claimed for this instrument.

A meter that is useful in meter testing

The case of this instrument is made of cast aluminum alloy, finished in black lacquer, and is provided with a black leather carrying strap. The white enamel dial is easily read against the black bakelite top. A light, rigid, aluminum alloy frame supports the entire meter element, and is firmly attached to the molded bakelite top. The base of the frame is flat, so that when the metering unit is removed from the case it stands upright on the bench, facilitating inspection or adjustments of the various elements.

On both full and light loads, adjustments are made with micrometer screws. The meter is also provided with an adjustment for regulating its operation on inductive loads. The one-ampere winding is protected from accidental overload or short circuit by a fuse, and a spare fuse is carried in the cover. A gasket between the top panel and the case makes the meter dust- and moisture-proof. The dial chamber is similarly protected by a gasket between the flange and top panel. A zero set-back device is controlled by a knurled bakelite knob. The terminals are also of molded bakelite with positive grips.

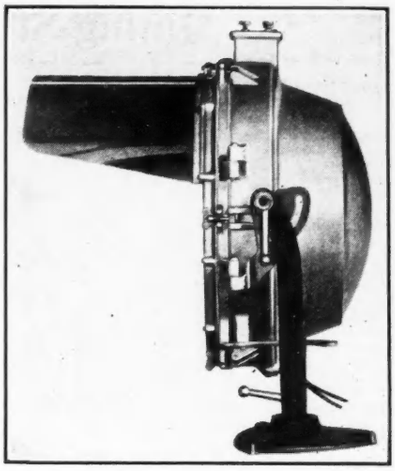
Large-Diameter Welding Rod Offers Many Advantages

A new welding rod is announced by the Lincoln Electric Co. of Cleveland, Ohio. This "dipped" steel rod is the result of several years of research and will be known as "Stable-Arc" welding rod. It is a companion to the "Kathode" welding rod which has been sold by the same company for many years. Considerably larger diameters are possible with this new rod than have been customary in rods for metal electrode welding in the past. The rod is carried in stock in all sizes up to ½ in.

It is claimed that this rod permits of much higher currents than have been used heretofore and that this results in greater speed. As labor is by far the largest factor in welding operations, increased speed means an appreciable decrease in welding cost. Not only does the higher temperature result in greater speed and lower costs but better penetration and a much smoother finished bead is also obtained. In addition, the greater heat obtainable by the higher currents occasions an annealing action which increases the ductility of the weld and gives a greater elongation. Current densities of 15,000 amp. and more per square inch can be used.

It is stated that "spluttering" of the arc is decreased and that this reduces spattering. As a result, more actual metal is deposited per pound of rod. The higher currents, it is said, result in a remarkably clean finished weld and on heavy work where more than one layer is used little brushing or cleaning is necessary between beads.

"Stable-Arc" welding rod is obtainable in 14-in. lengths in standard 50 lb. burlap-wrapped bundles. If desired, it can also be secured in longer lengths.



A sturdy and gas-proof headlight

Mine Locomotive Headlights of Rugged Construction

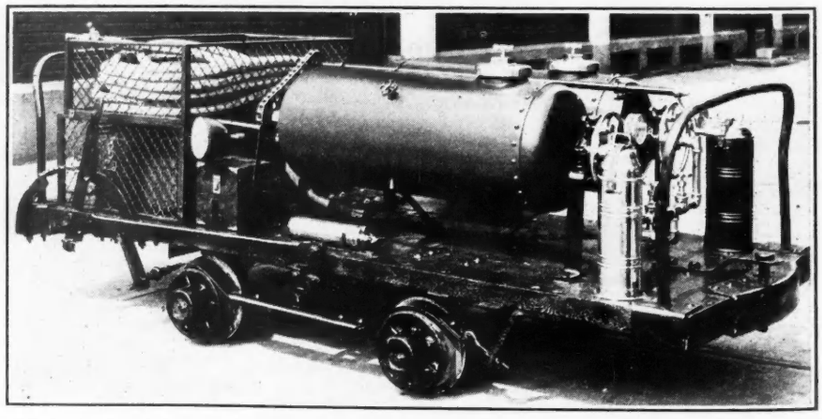
Improved types of mine locomotive headlights have just been announced by the Westinghouse Electric and Manufacturing Co., of East Pittsburgh, Pa. These are of sturdy design, which enables them to withstand the most severe operating conditions. They are constructed with spring suspensions which will protect the lamp filaments from breakage by vibrations and jars.

The Type L headlight has its lens holder fitted to the case with a threaded joint which, with rubber gaskets, tightly seals the apparatus. A heavy cast-iron grid protects the lens.

The Type S headlight is of approved gas-proof construction. The front cover is fitted to the case by machined threads with lead gaskets. Each side of the glass front allows an inch of actual creepage distance in all joints so that any gases ignited within the headlight will be cooled before getting out.

Fire Truck Suitable for Fighting Mine Fires

An American-La France fire truck has been announced by the Mine Safety Appliances Co. of Pittsburgh, Pa. In addition to the two main chemical tanks which appear prominently in the accompanying illustration and which are of 35, 45 or 60 gal. capacity each, making a total capacity of 70, 90 or 120 gal., this truck carries two carbon tetrachloride extinguishers and a chemical refill for one of the larger tanks. The truck also carries a headlight, a set of tools, six Burrell all-service gas masks, one carbon monoxide detector, and 200 ft. of hose with the necessary nozzle, spanner, and other useful accessories.



This truck-mounted equipment provides much valuable fire fighting apparatus